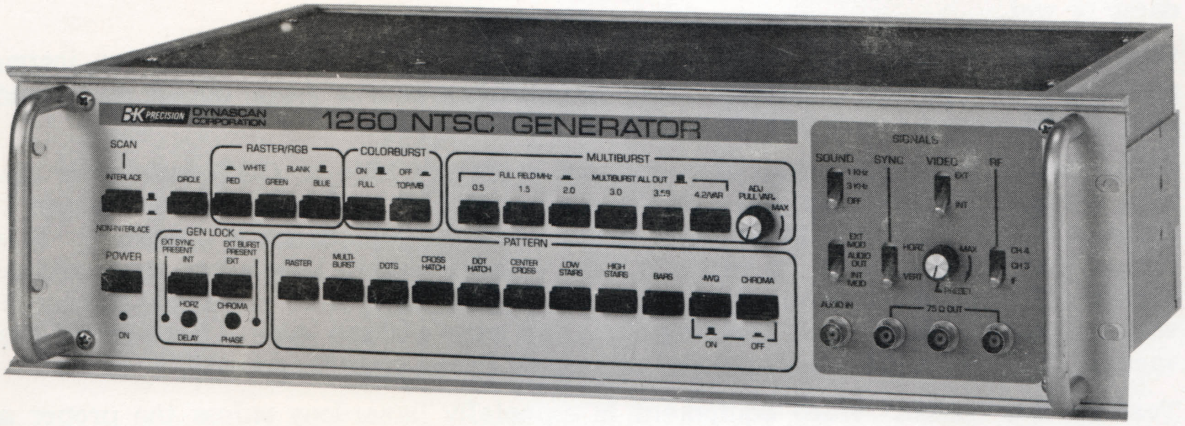
INSTRUCTION
MANUAL

B+K PRECISION **1260**

NTSC Generator



B+K PRECISION DYNASCAN
CORPORATION

TEST INSTRUMENT SAFETY

WARNING

Normal use of this instrument exposes you to a certain amount of danger from electrical shock because it is often used to test equipment that contains high voltage. An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltages are even more dangerous. Your normal work habits should include all accepted practices that will prevent contact with exposed high voltage, and that will steer current away from your heart in case of accidental contact with a high voltage. You will significantly reduce the risk factor if you know and observe the following safety precautions:

1. Connect the NTSC Generator's ac power cord only to a 3-wire outlet to assure that the instrument's chassis and ground leads of probes or test cables are at earth ground.
2. Don't expose high voltage needlessly in the equipment under test. Remove housings and covers only when necessary. Turn off equipment while making test connections in or near high-voltage circuits. Discharge high-voltage capacitors after removing power.
3. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.
4. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment; make certain such surfaces are not damp or wet.
5. Use the time-proven "one hand in the pocket" technique while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.
6. When testing video equipment that includes a picture tube or CRT, remember that the high voltage power supply and CRT anode operate at very high voltage, often 20,000 volts or more. Carefully avoid these areas when the equipment is operating. It is also typical for these circuits to retain a high voltage charge long after the equipment is turned off. Before attempting any servicing with the power removed, discharge high voltage points. Also avoid bumping the CRT with a sharp edge. Because of the high vacuum, a nicked CRT may "implode" and cause flying glass fragments.
7. Testing "hot chassis" video equipment is especially hazardous unless the proper safety precautions are taken. Most recent television receivers and other equipment with a two-wire ac power cord are the "hot chassis" type; this even includes many with polarized power plugs. A plastic or wooden cabinet usually insulates the chassis to protect the customer, but when the cabinet is removed for servicing there is great danger of serious electrical shock if the chassis is touched. To prevent electrical shock, always connect an isolation transformer between the ac outlet and any hot chassis equipment under test. The **B & K-Precision** Model 1604 or TR-110 Isolation Transformer, or Model 1653 or 1655 AC Power Supply is suitable for most applications. To be on the safe side, treat all two-wire ac powered equipment as "hot chassis" unless you are sure it has an isolated chassis or an earth ground chassis. Use of an isolation transformer has no disadvantage, even if it is not required.

(continued on inside back cover)

Instruction Model
for

B+K PRECISION

Model 1260
NTSC Generator

B+K PRECISION DYNASCAN
CORPORATION

6460 West Cortland Street
Chicago, Illinois 60635

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INTRODUCTION

The **B & K-Precision** Model 1260 NTSC Generator is a full featured, professional level television/video signal generator. It generates virtually every type of test signal and pattern needed for complete set-up, adjustment, testing, and servicing of all types of television and video equipment.

Standard features include generation of many different video patterns, including standard NTSC color bars, -IWQ, and staircase at two levels of burst phase chroma (each with on-off selection of chroma, full burst, or partial burst), a full assortment of convergence patterns, a full assortment of raster colors, and gated or full field multiburst. In addition, a circle may be superimposed on any of these patterns.

Each video pattern is available as a composite video signal or as a modulated rf output on channel 3, channel 4, or the standard i-f frequency of 45.75 MHz.

A TCXO assures stable, accurate frequency and timing control of sync, color burst, and chroma signals. Other features include gen lock, RGB output, and selectable interlaced or progressive vertical scan. Gen lock allows the sync and color burst to be synchronized to an external composite video signal if desired. Horizontal delay and chroma phase are adjustable for precise gen lock synchronization. RGB output provides independent red, green, and blue test signals for direct gun inputs on RGB color monitors.

An external video input permits the rf or i-f output to be externally modulated for testing and adjustment of video cameras.

In addition to video signals, the instrument generates 1 kHz and 3 kHz audio tones and accepts external audio, any of which can be used to FM modulate the rf output with the standard 4.5 MHz intercarrier. The 1 kHz and 3 kHz audio tones are also available for external use. A 3 kHz tone is recommended for video tape recorder applications.

A wide assortment of auxiliary input and output signals are available such as black burst, selectable horizontal or vertical sync, continuous horizontal sync, composite sync, composite blanking, subcarrier output, and multiburst output. For complete versatility, most outputs are independent and may be used simultaneously if desired.

Applications for the Model 1260 NTSC Generator include television receivers, video tape recorders, video cassette recorders, video disc players, video cameras, video monitors, computer terminals, television studio and broadcasting equipment, closed circuit television systems and components, and cable and master antenna systems and components.

The NTSC signals generated by the instrument are identical to those used by the television networks to set-up and adjust their studio and transmitting equipment. In fact, the NTSC Generator is often used in that application. Studios and transmitting stations continuously monitor their equipment to maintain signals at those NTSC standards. This feature makes the instrument ideal for servicing, production line, and design lab applications. Since the NTSC Generator produces the same type of signal used by the television industry, it permits set-up and adjustment of video equipment for the best performance.

This NTSC Generator has the precision required for broadcast studios or transmitting equipment, closed circuit television studios and networks, design labs, and production test facilities, yet is practical for service shops. The instrument is ideal for testing and servicing video tape recorders (including video cassette recorders) and video disc players, as well as color television receivers. The service literature for most video tape recorders specify an NTSC Generator if complete testing and adjustment is to be performed. It is equally effective in the set-up and maintenance of cable television and master antenna networks. An engineer or technician with a good knowledge of video circuits can use the variety of patterns and signals to analyze and isolate almost any video problem.

FEATURES

TCXO STABILITY
Time base for all sync, pattern, color burst, and chroma generation TCXO controlled.

CRYSTAL OSCILLATORS
I-F, CH 3, CH 4 crystal-controlled for frequency accuracy and stability.

INTERLACED OR PROGRESSIVE SCAN
Selectable interlaced scan for NTSC patterns, progressive scan for convergence patterns.

GEN LOCK
Sync generator can be locked to external composite video signal. Horizontal delay and chroma phase front panel adjustable. Convenient loop-thru connection allows multiple units to gen lock to same source.

CIRCLE PATTERN
Circle pattern gives quick visual linearity check. Circle size at 73% of vertical scan assures full circle is displayed on sets with overscan. Independent on-off selection allows circle to be superimposed on any pattern.

RGB OUTPUTS
Red, green, and blue outputs along with positive polarity vertical and horizontal sync for testing RGB color monitors. Raster, convergence, multiburst, staircase and circle patterns available in all eight standard EIA raster colors. Individual BNC jacks and standard 9-pin RGB jack where all outputs are available at a single connector.

BLACK BURST OUTPUT
Continuous black burst output available at rear panel.

COMPOSITE BLANKING OUTPUT
Composite blanking output available at rear panel.

UNIVERSAL HOUSING
Standard unit may be rack mounted; fully enclosed housing for bench top use.

RACK MOUNT SLIDE KIT AVAILABLE
Unit slides out for access with optional accessory rack mount slide kit.

NTSC COLOR BARS
Generates standard NTSC color bars pattern (eight bars of standard EIA colors) at NTSC prescribed luminance and chroma levels and phase.

-IWQ SIGNAL
Generates standard NTSC prescribed -IWQ pattern on bottom 1/4 of color bars pattern, or -IWQ pattern can be switched off for full color bars.

STAIRCASE
Generates NTSC prescribed staircase pattern of five equal steps of increasing luminance. Measures differential gain and differential phase. Selectable burst phase chroma of 20 or 40 IEEE units.

SELECTABLE CHROMA
Chroma can be switched on or off.

SELECTABLE BURST
Burst can be switched on or off for full pattern, or can be switched off for top 1/4 of pattern only.

MULTIBURST PATTERN
Equal amplitude steps of white, and sine wave video at 0.5 MHz, 1.5 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz. Checks horizontal resolution and video bandwidth.

FULL FIELD MULTIBURST
Selectable full field video at 0.5 MHz, 1.5 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, or 4.2 MHz.

VARIABLE MULTIBURST
Selectable variable mode changes 4.2 MHz step of multiburst or 4.2 MHz full field video to variable frequency, adjustable from approximately 2 to 7 MHz. Permits measurement of bandwidth cutoff frequency or maximum resolution.

CONVERGENCE PATTERNS
Dots, crosshatch, dot-hatch, and center cross patterns for static and dynamic convergence.

RASTER PATTERNS
Raster pattern in all eight EIA colors at

NTSC prescribed luminance and chroma levels and phase.

LOGICAL CONTROL LAYOUT
Functionally related controls are clustered and identified for ease of operation.

COMPOSITE VIDEO OUTPUT
Composite video output at preset 1-volt peak-to-peak amplitude or variable 0- to 1.5-volt peak-to-peak amplitude into standard 75 Ω impedance.

RF OUTPUT
Standard 75 Ω output modulated by composite video (and sound if desired) at 5 mV rms (into 75 Ω) on channel 3, channel 4, or 45.75 MHz i-f.

EXTERNAL VIDEO INPUT
External composite video signal will modulate rf output. Test, troubleshoot, and adjust video cameras. Accepts standard 1-volt peak-to-peak signal into 75 Ω impedance.

SOUND
Generates internal 1 kHz or 3 kHz audio tone and FM modulates rf output with standard 4.5 MHz sound intercarrier.

EXTERNAL AUDIO INPUT
External audio signal will FM modulate rf output with 4.5 MHz sound intercarrier with standard 75 μs pre-emphasis characteristic. Accepts 1- to 3-volt peak-to-peak audio signal of 100 Hz to 10 kHz into 10 kΩ input impedance.

EXTERNAL AUDIO OUTPUT
1 kHz and 3 kHz audio tones available for external use. VTR applications recommend 3 kHz. Output is 3 volts peak-to-peak into 1 kΩ.

SYNC PULSE OUTPUTS
Selectable horizontal or vertical sync pulse output available at front panel for triggering oscilloscope. Continuous horizontal sync pulse available at rear panel. Positive polarity horizontal and vertical sync pulse available at rear panel. Composite sync pulse available at rear panel.

SUBCARRIER OUTPUT
3.58 MHz subcarrier available for external measurement on frequency counter.

MULTIBURST OUTPUT
Multiburst available for external measurement on frequency counter. Convenient for setting multiburst variable frequency and for multiburst calibration adjustment.

SIMULTANEOUS OUTPUTS
Most outputs can be used simultaneously for maximum flexibility. Permits more complete complementary testing or multiple independent usage of instrument.

TELEVISION STUDIO AND TRANSMITTING STATION APPLICATIONS
Provides the type of signals and precision required to set-up and maintain studio and transmitting equipment to NTSC standards.

DESIGN LAB APPLICATIONS
Generation of test signals for proving designs of video products.

TELEVISION SERVICING APPLICATIONS
Comprehensive testing, analysis, convergence, alignment, troubleshooting, and repair of color or black and white television receivers. Permits adjustments to same standards being used by broadcast transmitting stations for highest quality picture and sound.

VTR, VCR AND VIDEO DISC APPLICATIONS
This instrument provides the types of signals and the degree of precision needed for complete testing, servicing, and adjustment of video tape recorders, video cassette recorders, and video disc players.

VIDEO CAMERA APPLICATIONS
External video input allows testing, troubleshooting, and adjustment of color or black and white video cameras.

VIDEO MONITOR APPLICATIONS
Install, set-up, adjust, and service color or black and white video monitors or RGB color monitors used in computer terminals, word processor terminals, etc.

CABLE TV APPLICATIONS
Install, adjust, service, and maintain CATV (cable television) and MATV (master antenna television) systems and networks at peak performance capability.

CCTV APPLICATIONS
Set-up and maintain CCTV (closed circuit television) systems and equipment to same precision and standards as television networks.

PRODUCTION LINE APPLICATIONS
Comprehensive testing of nearly any type of video product.

SPECIFICATIONS

PATTERNS

NTSC Color Bars
White (75%), yellow, cyan, green, magenta, red, blue, black (7.5% set-up).

-IWQ
-I, white (100%), Q, black. Switch selectable on or off with NTSC color bars. Pattern appears on bottom 1/4 of vertical scan.

Top Burst Off
Switch selectable (top 1/4 of vertical scan).

Full Burst Off
Switch selectable.

Chroma Off
Switch selectable.

Circle
May be superimposed on any pattern.

Dots
19 x 15.

Crosshatch
19 x 15.

Dot Hatch
Dots and crosshatch.

Center Cross
1 vertical and 1 horizontal line.

Linear Staircase
5 equal steps.

High or Low Chroma Staircase
Burst phase chroma, 40 or 20 IEEE units.

Raster
Black (7.5%), red, blue, green, yellow, cyan, magenta, white (75%).

Multiburst

Gated Multiburst
Six fixed frequencies (0.5, 1.5, 2.0, 3.0, 3.58 and 4.2 MHz ±5%) with a leading white level.

Full Field
Any one of the six frequencies selectable for full field display.

Variable Frequency
One selectable variable frequency may be substituted for 4.2 MHz as the sixth frequency or full field (variable from 2 MHz to 8 MHz ±1MHz).

Amplitude Flatness
±1 dB to 4.2 MHz.

GEN LOCK

Generator synchronizes horizontal and vertical sync and color burst with external 1 V p-p NTSC video input. Adjustments on front panel for horizontal delay and chroma phase. BNC connector on rear panel for loop through.

SYNCHRONIZATION

Type
59.94 Hz field of 525 lines, interlaced scan; 262 lines non-interlaced scan.

Horizontal Frequency
15.734 kHz.

Vertical Frequency
59.94 Hz.

Horizontal Blanking
10.76 µs.

Vertical Blanking
1.33 ms.

Horizontal Sync
4.89 µs.

Front Porch
1.47 µs.

Burst
8 cycles minimum 3.58 MHz.

Equalizing Pulse
2.44 µs.

TRIGGER OUTPUT

Type
Horizontal or vertical sync pulse available at front panel, switch selectable.

Horizontal sync pulse available on rear panel.

Voltage
TTL level.

Impedance
75 ohms.

Polarity
Negative going sync.

SUBCARRIER OUTPUT

Frequency
3.579545 MHz (±5 Hz 0° to +40° C).
Setability ±1 Hz; TCXO.

Voltage
Approx. 1 V p-p, no load.

Impedance
75 ohms.

VIDEO OUTPUT

Composite Video Voltage
Preset = 1 V p-p.
Variable = 0 to 1.5 V p-p.

Impedance
75 ohms.

Polarity
Positive (negative sync).

RF OUTPUT

Modulation
Negative.

Carrier Frequency
Crystal controlled.
CH 3 = 61.25 MHz.
CH 4 = 67.25 MHz.
I-F = 45.75 MHz..

Voltage
5 mV rms minimum into 75 Ω.

Impedance
75 ohms.

External Video Input
Switch selectable; requires 1 V p-p, 75 Ω input.

SOUND OUTPUT

RF Modulation
4.5 MHz FM-modulated intercarrier (±25 kHz deviation with internal 3 kHz audio signal).

Internal Signal
3 kHz or 1 kHz.

Audio Output
3 V p-p into 1 kΩ.

External Audio Input
1 to 3 V p-p, 100 Hz to 10 kHz,
pre-emphasis of 75 µs.

Input Impedance
10 kΩ.

BLACK BURST OUTPUT

Continuous output consisting of negative sync (286 mV p-p), color burst (286 mV p-p), and black level; 75 Ω.

COMPOSITE SYNC OUTPUT

-4 V into 75 Ω.

COMPOSITE BLANKING OUTPUT

-4 V into 75 Ω.

RGB OUTPUT

Outputs
Red, green, and blue outputs to drive 525 line color monitors.

Video Patterns
Convergence, full field raster, multiburst, circle, and staircase.

Voltage
High/low selectable. Use low level for staircase.
Low level approx. 1 V into open circuit.
High level > 2.4 V into open circuit (TTL).

Sync
Horizontal and vertical sync; > 2.4 V into open circuit (TTL).

Polarity
Positive sync.
Positive RGB.

MULTIBURST OUTPUT

Multiburst output available at rear panel for frequency measurement.

Voltage > 2.4 V p-p into open circuit.

Impedance 1 kΩ.

MISCELLANEOUS

Input Power Requirements
105-130 VAC, 60 Hz, approx. 22 W.

Operating Temperature
0° to +50° C. Specifications apply for operating temperature of +18° to +28° C unless otherwise noted. Temperature coefficient less than 0.1 times the stated accuracy per °C.

Dimensions (HWD)
5-5/16 x 19 x 14" (135 x 483 x 356 mm).

Weight
14 lb (6.36 kg).

ACCESSORIES SUPPLIED

Instruction Manual
Schematic Diagram & Parts List.

OPTIONAL ACCESSORIES

Model RM-20 Rack Mount Slide Kit.

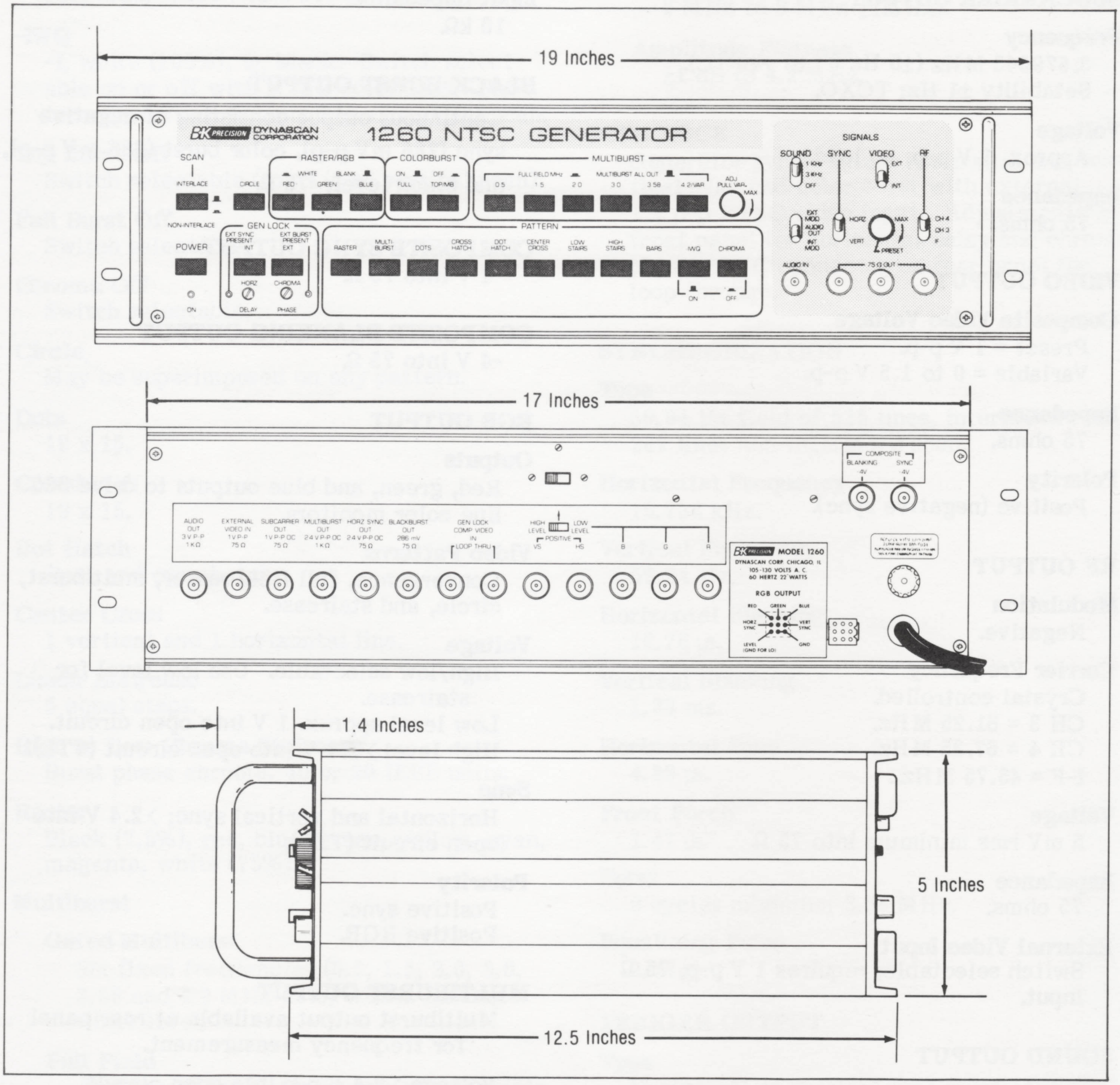


Fig. 1. Dimensional Detail.

DEFINITIONS OF TERMS

BARS Pattern. See "NTSC Color Bars".

B-Y. A color signal at 0° on the standard vector diagram. It is formed from a combination of red, green, and blue (-0.30R -0.59G +0.89B). Any color on the vector diagram can be made from a combination of B-Y (0°) and R-Y(90°), or their counterparts -(B-Y) and -(R-Y) at 180° and 270° respectively.

-(B-Y). A color signal at 180°. This is also the phase of the color burst. Also see "B-Y".

Back Porch. The portion of a composite video signal between the trailing edge of the horizontal sync pulse and the end of the horizontal blanking pedestal. The color burst occurs during the back porch interval.

Black Burst. A test signal consisting of composite sync, color burst, and video at 0% luminance (blanking level, or black) with no chroma.

Blanking Level. The level of the front and back porches. Zero IEEE units.

Burst. See "Color Burst".

CATV. Cable Television. Also used for Community Antenna Television.

CCTV. Closed-circuit television.

Chroma or Chrominance. The color information contained in a video signal, consisting of hue (phase angle) and saturation (amplitude) of the color subcarrier.

Chroma Amplitude. Amplitude of 3.58 MHz color subcarrier. Represents saturation.

Chroma Phase Adjustment. Phase adjustment of 3.58 MHz color burst. Permits adjustment to match external signal in gen lock operation.

Chroma Phase Angle. Phase angle of 3.58 MHz color subcarrier. Represents hue.

Color Bars. See "NTSC Color Bars".

Color Burst. A few (8 to 10) cycles of 3.58 MHz color subcarrier which occur during the back porch interval. Color burst amplitude is 40 IEEE units and phase is 180°. The color oscillator of a color television receiver is phase locked to the color burst.

Color Subcarrier. The 3.58 MHz signal which carries color information. This signal is superimposed on the luminance level. Amplitude of the color subcarrier represents saturation and phase angle represents hues.

Composite Blanking. A signal consisting of horizontal blanking pulses (pulses the width of the horizontal blanking pedestal) and vertical blanking pulses (pulses the width of the vertical blanking interval) only, with a no-signal reference level.

Composite Sync. A signal consisting of horizontal sync pulses, vertical sync pulses, and equalizing pulses only, with a no-signal reference level.

Composite Video Signal. The entire video signal consisting of blanking pulses, sync pulses, color burst, and chroma and luminance information.

De-Emphasis. An audio coupling circuit which has an RC time constant such that high frequency audio is de-emphasized; i.e., is less readily coupled than low frequency audio. Television receivers use de-emphasis in the sound circuit. The de-emphasis slope is equal and inverse of the pre-emphasis slope used in transmission, resulting in an overall flat response. Also see "Pre-Emphasis".

Differential Gain. A change of chroma gain as a result of varying the luminance level. The staircase patterns of the NTSC Generator are useful for measuring differential gain, which can cause saturation distortion.

Differential Phase. A phase shift of the 3.58 MHz color subcarrier as a result of varying the luminance level. The staircase patterns may also be used to measure differential phase, which can cause hue distortion.

Duty Cycle. Percentage of cycle during which pulse is working. A square wave has a 50% duty cycle. Horizontal sync pulses have about 8% duty cycle - about 5 µs pulse width at 63.5 µs pulse repetition period.

EIA. Electronic Industries Association.

Equalizing Pulse. A portion of the vertical blanking interval which is made up of blanking level and six pulses (8% duty cycle at -40 IEEE units) at one-half the width of horizontal sync pulses and at twice the repetition rate. One equalizing pulse occurs immediately before, and another immediately after, the vertical sync pulse.

Field. One-half of a television picture. One complete vertical scan of the picture, containing 262.5 lines. Two fields make up a complete television picture (frame). The lines of Field 1 are vertically interlaced with Field 2 for 525 lines of resolution.

Frame. A complete television picture, consisting of two fields. See "Field".

Front Porch. That portion of a composite video signal which drops to blanking level at end of a line of horizontal scan, before the horizontal sync pulse.

Full Field Multiburst. A pattern that fills the entire sceen with one specific sine wave video frequency. Any frequency of the gated multiburst pattern may be selected.

Gated Multiburst. A pattern generated by the NTSC Generator for checking horizontal resolution and bandwidth. The pattern includes bursts of sine wave video at frequencies of dc (100% white), 0.5 MHz, 1.5 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz. The sine wave video produces alternate black and white lines. As the video frequency increases, the lines in the pattern become closer together.

Gen Lock. Mode of operation in which the sync generator of an NTSC Generator is locked to (synchronized with) an external composite video signal. In gen lock operation, horizontal delay and chroma phase must be adjusted to coincide with the external signal. Also see "Chroma Phase Adjustment" and "Horizontal Delay Adjustment".

Horizontal Blanking Pedestal. That portion of each line of composite video signal which blanks the picture while the CRT retrace returns to the left side of the screen. Consists of front porch, horizontal sync pulse, and back porch.

Horizontal Delay Adjustment. Adjustment of horizontal sync timing in relation to external horizontal sync. Permits adjustment to match external source in gen lock operation.

Horizontal Resolution. Smallest increment of a television picture that can be discerned in the horizontal plane. This increment is dependent upon the video bandwidth and is measured in frequency. Horizontal resolution of a high quality monochrome television receiver is 4.2 MHz.

Horizontal Sync Pulse. Pulse at -40 IEEE units which synchronizes horizontal scan rate of television receiver to composite video signal. Starts each line at same horizontal position.

Hue. Distinction between colors. Red, blue, green, yellow, etc. are hues. White, black, and gray are not considered hues.

I. Color signal at 123°. The I signal is also a designation for a signal containing color information in the 0.5 to 1.5 MHz band, representing small areas of color for picture detail, before being used to modulate the 3.58 MHz color subcarrier. See also "-I" and "Q".

-I. A color signal at 303°. An NTSC designated phase angle reference used in studio equipment. Phase angle -I and Q are separated 90°. With their counterparts I and -Q, a full 360° vector can be generated. In this respect, I and Q are equivalent to B-Y and R-Y.

-IWQ. A pattern generated by the NTSC Generator, consisting of equal parts -I (40 units chroma at 303°), W (100% white), Q (40 units chroma at 33°), and black. The -IWQ pattern occurpies the lower 1/4 of vertical scan beneath the NTSC color bar pattern.

IEEE. Institute of Electrical and Electronic Engineers.

IEEE Unit. A standard 1-volt peak-to-peak composite video signal is divided into 140 equal units, scaled from -40 to +100, which are then called IEEE units. Luminance and chroma amplitude are measured in IEEE units. Sync pulses extend from 0 to -40 units. Blanking level is 0. Picture information spans the +7.5 set-up level (black) to +100 (100% white) levels. Chroma amplitude is the peak-to-peak amplitude of the color subcarrier, which rides on the luminance level.

Interlace. Vertical offset between Field 1 and Field 2 that causes lines of Field 1 to fall between the lines of Field 2. Also see "Field".

Loop Thru. Pair of parallel input terminals. An input signal applied to one terminal provides an input to the instrument and an identical output signal at the other terminal. Thus, the signal is looped through the instrument and made available for further external use.

Luminance. The amount of light intensity perceived by the eye as brightness. Luminance information is represented by the amplitude of the composite video signal.

MATV. Master antenna television.

Monochrome. Black and white television signal. Contain sync and luminance but no color burst or chroma.

Multiburst. Same as "Gated Multiburst". Also see "Full Field Multiburst".

Non-Interlaced Scan. Each vertical field consists of 262 lines, and the lines of Field 1 are not offset from the lines of Field 2.

NTSC. National Television Systems Committee. Established the color television standards now in use in the U.S.A. and many other nations of the world.

NTSC Color Bars. A pattern generated by the NTSC Generator, consisting of eight equal width color bars. Colors are white (75%), black (7.5% set-up level), 75% saturated pure colors red, green, and blue, and 75% saturated hues of yellow, cyan, and magenta (mixtures of two colors in 1:1 ratio without third color).

Pre-Emphasis. An audio coupling circuit which has an RC time constant such that high frequency audio is emphasized; i.e., is more readily coupled than low frequency audio. Audio used for television sound is pre-emphasized before modulation. Also see "De-Emphasis".

Progressive Scan. See "Non-Interlaced Scan".

Q. Color signal at 33°. The Q signal is also a designation for a signal containing color information in the 0 to 0.5 MHz band, representing large areas of color, before being used to modulate the 3.58 MHz color subcarrier. See also "I" and "-I".

-Q. A color signal at 213°. See also "Q" and "I".

RGB. Term used to describe signals applied directly to red, green, and blue guns (as opposed to composite video signals wherein hue and saturation are determined by the phase and amplitude of the 3.58 MHz color subcarrier).

R-Y. A color signal at 90° on the standard vector diagram. It is formed from a combination of red, green, and blue chroma (+0.70R -.59G -0.11B). Also see "B-Y".

-(R-Y). A color signal at 270°. Also see "R-Y" and "B-Y".

Resolution. See "Horizontal Resolution" and "Vertical Resolution".

Saturation. Vividness of color. Degree to which a color is not diluted by white light. Highly saturated color is very vivid. The same hue becomes a pastel shade when diluted by white light. Saturation is represented by chroma amplitude and is measured in IEEE units. The number of IEEE units for fully saturated color varies from hue to hue.

Set-Up. The separation between blanking and black reference levels. This instrument uses the NTSC standard set-up level of 7.5 units.

Staircase. A pattern generated by the NTSC Generator, consisting of equal width luminance steps of 0, +20, +40, +60, +80, and +100 IEEE units and a constant amplitude chroma signal at color burst phase. Chroma amplitude is selectable at 20 IEEE units (LOW STAIRS) or 40 IEEE units (HIGH STAIRS). The staircase pattern is useful for checking linearity of luminance and chroma gain, differential gain, and differential phase.

Subcarrier. See "Color Subcarrier".

VCR. Video cassette recorder.

Vertical Blanking Interval. That portion at the beginning of each field of composite video signal which blanks the picture while the CRT retrace returns to the top of the screen. The equalizing pulses and vertical sync pulse are generated within this interval.

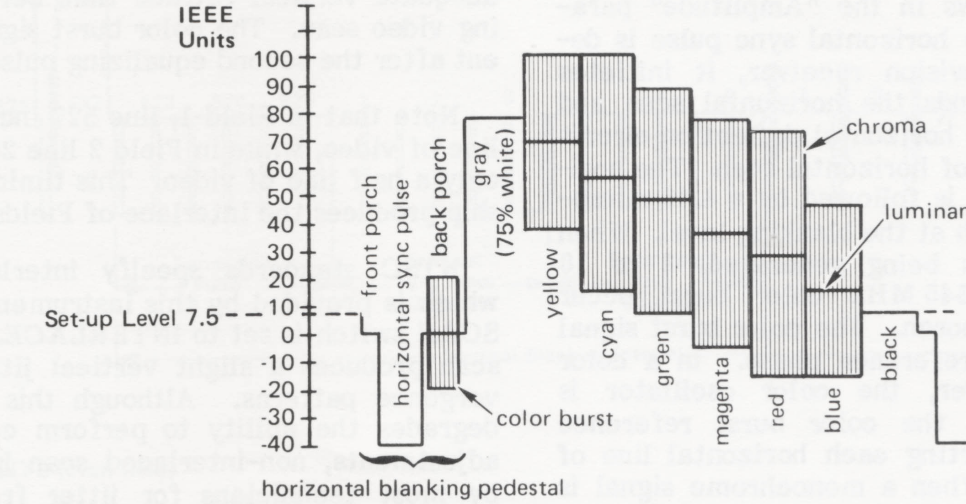
Vertical Resolution. Smallest increment of a television picture that can be discerned in the vertical plane. This increment is dependent upon the number of lines of scan per frame, and is measured in lines. In the U.S.A. and other countries using NTSC systems, vertical resolution is 525 lines. Vertical resolution is 262 lines when using non-interlaced scan.

Vertical Sync Pulse. A portion of the vertical blanking interval which is made up of blanking level and six pulses (92% duty cycle at -40 IEEE units) at twice the horizontal sync pulse repetition rate. Synchronizes vertical scan of television receiver to composite video signal. Starts each frame at same vertical position (sequential fields are offset 1/2 line to achieve interlaced scan).

VTR. Video tape recorder. In this manual, the term "VTR" includes reel-to-reel and cassette type.

Y Signal. The black and white portion of a video signal. Same as luminance.

THE NTSC COLOR VIDEO SIGNAL



IEEE Units →

LUMINANCE	0	-40	0	77	69	56	48	36	28	15	7.5
CHROMA AMPLITUDE	–	–	40	–	62	88	82	82	88	62	–
VECTOR (FROM B-Y)	–	–	180°	–	167°	284°	241°	61°	104°	347°	–

Fig. 2. Composite Video Signal; One Horizontal Line of NTSC Color Bars Signal.

HISTORY

In 1953, the NTSC (National Television Systems Committee) established the color television standards now in use by the television broadcast industry in the United States and many other countries. It was, of course, compatible with the monochrome (black and white) system that previously existed. The makeup of a composite video signal is dictated by NTSC specifications. These specifications include a 525-line interlaced scan, operating at a horizontal scan frequency of 15,734.26 Hz and a vertical scan frequency of 59.94 Hz. A 3.579545 MHz subcarrier contains the color information. The phase angle of the subcarrier represents the hue; the amplitude of the subcarrier represents saturation.

HORIZONTAL SYNC
(refer to Fig. 2)

The "beginning" of a line of horizontal scan occurs at the leading edge of the horizontal blanking pedestal. In a television receiver, the horizontal blanking pedestal starts as the electron beam of the CRT reaches the extreme right-hand edge of the screen (plus a little overscan in most cases). The horizontal blanking pedestal prevents illumination of the screen during retrace, that is, until the electron beam deflection circuits are reset to the left edge of the screen and ready to start another line of video display. The entire horizontal blanking pedestal is at the blanking level or the sync pulse level. In a television receiver, the blanking and sync pulse levels are the "blacker than black" levels that assure no illumination during retrace.

The horizontal blanking pedestal consists of three discrete parts: the front porch, the horizontal sync pulse, and the back porch. The front porch is a 1.47 microsecond period at blanking level. The front porch is followed by a 4.89 microsecond horizontal sync pulse at the -40 IEEE units level. An explanation of IEEE units follows in the "Amplitude" paragraph. When the horizontal sync pulse is detected in a television receiver, it initiates flyback, which ends the horizontal scan and rapidly resets the horizontal deflection circuit for the next line of horizontal scan. The horizontal sync pulse is followed by a 4.40 microsecond back porch at the blanking level. When a color signal is being generated, 8 to 10 cycles of 3.579545 MHz color burst occur during the back porch. The color burst signal is at a specific reference phase. In a color television receiver, the color oscillator is phase locked to the color burst reference phase before starting each horizontal line of video display. When a monochrome signal is being generated, there is no color burst during the back porch.

VERTICAL SYNC (refer to Fig. 3)

A complete video image as seen on a TV screen is called a frame. A frame consists of two interlaced vertical fields of 262.5 lines each. The image is scanned twice at a 60 Hz rate (59.94 Hz to be more precise), and the lines of Field 2 are offset to fall between the lines of Field 1 (interlaced) to create a frame of 525 lines at a 30 Hz repetition rate.

At the beginning of each vertical field, a period equal to several horizontal lines is used for the vertical blanking interval. In a television receiver, the vertical blanking interval prevents illumination of the CRT during the vertical retrace. The vertical sync pulse, which is within the vertical blanking interval, initiates reset of the vertical deflection circuit so the electron beam will return to the top of the screen before video scan resumes. The vertical blanking interval begins with the first equalizing pulse, which consists of six pulses one half the width of horizontal sync pulses, but at twice the repetition rate. The equalizing pulse has an 8% duty cycle. The vertical sync pulse occurs immediately after the first equalizing pulse. The vertical sync pulse is an inverted equalizing pulse at 92% duty cycle. The wide portion of the pulse is at the -40 IEEE units level and the narrow portion of the pulse at the blanking level. A second equalizing pulse at 8% duty cycle occurs after the vertical sync pulse, which is then followed by 13 lines of blanking level (no video) and horizontal sync pulses to assure adequate vertical retrace time before resuming video scan. The color burst signal is present after the second equalizing pulse.

Note that in Field 1, line 522 includes a full line of video, while in Field 2 line 260 contains only a half line of video. This timing relationship produces the interlace of Fields 1 and 2.

NTSC standards specify interlaced scan, which is provided by this instrument when the SCAN switch is set to INTERLACE. Interlaced scan produces a slight vertical jitter in convergence patterns. Although this in no way degrades the ability to perform convergence adjustments, non-interlaced scan is preferred by most technicians for jitter free convergence patterns. This instruments also offers non-interlaced scan when desired by setting the SCAN switch to NON INTERLACE. With non-interlaced scan, Field 1 and Field 2 are identical, consisting of 262 lines each with no vertical offset.

AMPLITUDE (refer to Fig. 2)

A standard NTSC composite video signal is 1 volt peak-to-peak, from the tip of a sync pulse to 100% white. This 1 volt peak-to-peak signal is divided into 140 equal parts called IEEE units. The zero reference level for this signal is the blanking level. The tips of the sync pulses are at -40 units, and a sync pulse is approximately 0.3 volt peak-to-peak. The portion of the signal that contains video information is raised to a set-up level of +7.5 units above the blanking level. A monochrome video signal at +7.5 units is at the black threshold. At +100 units the signal represents 100% white. Levels between +7.5 and +100 units produce various shadings of gray. Even when a composite video signal is not at the 1 volt peak-to-peak level, the ratio between the sync pulse and video must be maintained, 0.3 of total for sync pulse and 0.7 of total for 100% white.

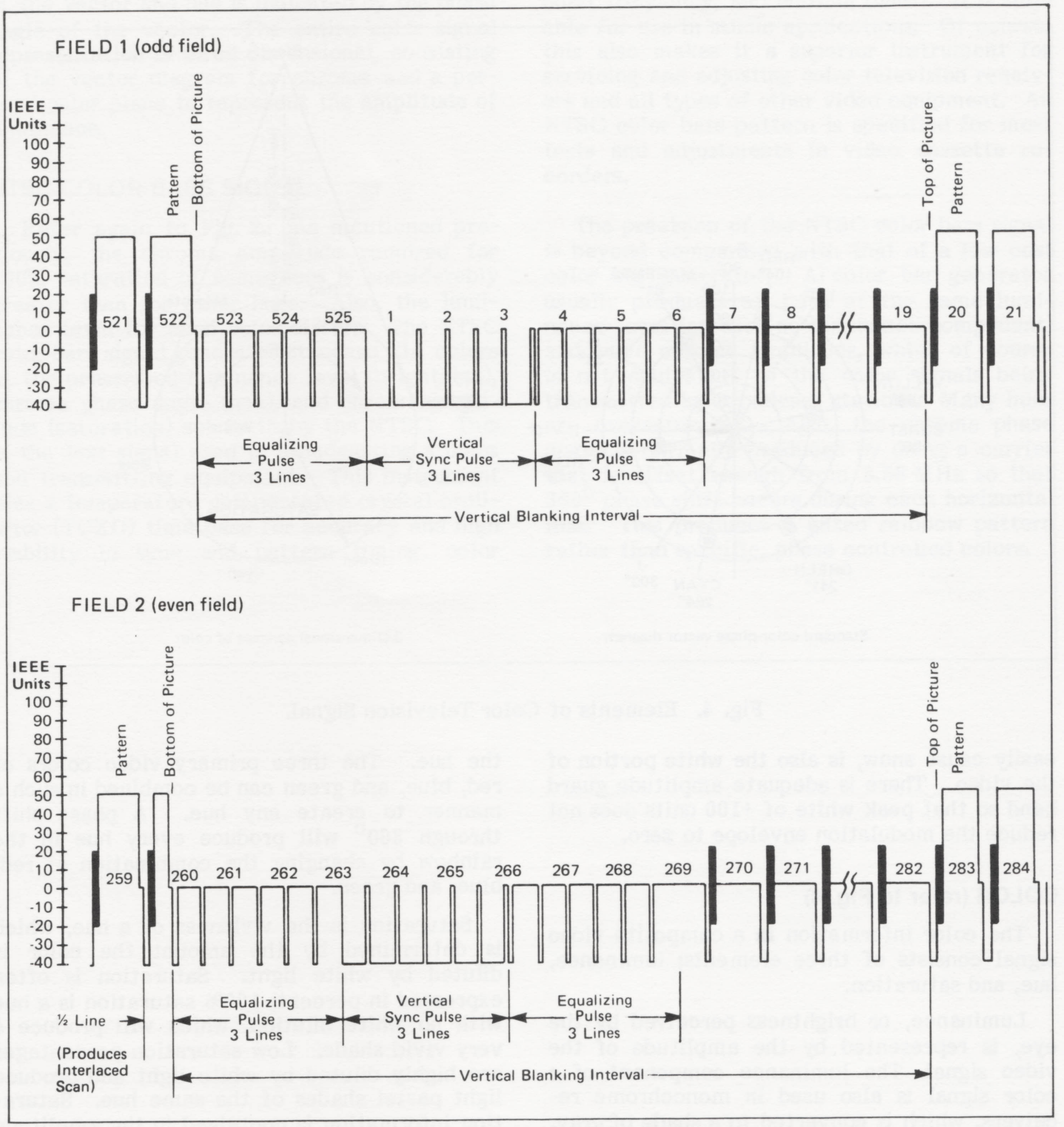
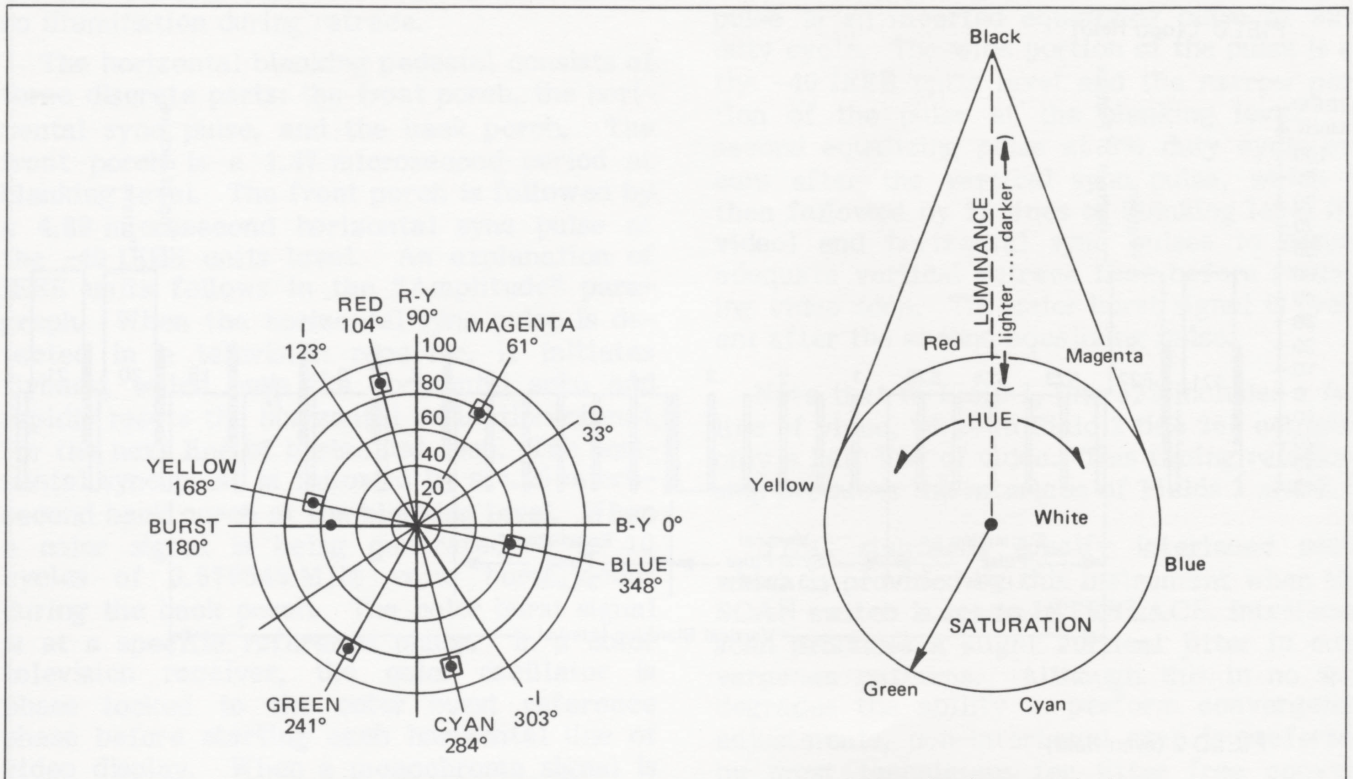


Fig. 3. Composite Video Signal Showing Vertical Blanking Interval.

There is also a specific relationship between the amplitude of the composite video signal and the percentage of modulation of an rf carrier. A television signal uses negative modulation, wherein the sync pulses (-40 units) produce the maximum peak-to-peak amplitude of the modulation envelope (100% modulation) and white video (+100 units) produces the minimum amplitude of the modulation envelope (12-1/2% modulation). This is very advantageous, because the weakest signal condition, where noise interference can most



Standard color-phase vector diagram

3-Dimensional concept of color

Fig. 4. Elements of Color Television Signal.

easily cause snow, is also the white portion of the video. There is adequate amplitude guard band so that peak white of +100 units does not reduce the modulation envelope to zero.

COLOR (refer to Fig. 4)

The color information in a composite video signal consists of three elements; luminance, hue, and saturation.

Luminance, or brightness perceived by the eye, is represented by the amplitude of the video signal. The luminance component of a color signal is also used in monochrome receivers, which is converted to a shade of gray. Yellow is a bright color and has a high level of luminance (is nearer to white), while blue is a dark color and has a low level of luminance (is nearer to black).

Hue is the element that distinguishes between colors, red, blue, green, etc. White, black and gray are not hues. The phase angle of the 3.58 MHz color subcarrier determines the hue. The three primary video colors of red, blue, and green can be combined in such a manner to create any hue. A phase shift through 360° will produce every hue in the rainbow by changing the combination of red, blue, and green.

Saturation is the vividness of a hue, which is determined by the amount the color is diluted by white light. Saturation is often expressed in percent; 100% saturation is a hue with no white dilution, which will produce a very vivid shade. Low saturation percentages are highly diluted by white light and produce light pastel shades of the same hue. Saturation information is contained in the amplitude of the 3.58 MHz color subcarrier. Because the response of the human eye is not constant from hue to hue, the amplitude required for 100% saturation is not the same for all colors.

The combination of hue and saturation is known as chroma, or chrominance. This information is normally represented by a vector diagram. Saturation is indicated by the length of the vector and hue is indicated by the phase angle of the vector. The entire color signal representation is three dimensional, consisting of the vector diagram for chroma and a perpendicular plane to represent the amplitude of luminance.

NTSC COLOR BARS SIGNAL

Refer again to Fig. 2. As mentioned previously, the chroma amplitude required for 100% saturation of some hues is considerably greater than for other hues. Also, the luminance level for each color differs. The NTSC color bars signal generates standard EIA colors at the prescribed luminance level (brightness), chroma phase angle (hue), and chroma amplitude (saturation) set forth by the NTSC. This is the test signal used in broadcasting studios and transmitting equipment. This instrument uses a temperature compensated crystal oscillator (TCXO) time base for accuracy and high stability in sync and pattern timing, color burst frequency, and chroma (hues). It is suitable for use in studio applications. Of course, this also makes it a superior instrument for servicing and adjusting color television receivers and all types of other video equipment. An NTSC color bars pattern is specified for most tests and adjustments in video cassette recorders.

The precision of the NTSC color bars signal is beyond comparison with that of a low cost color bar generator. A color bar generator usually produces all hues at the same luminance level (or with no luminance component) and same chroma amplitude, which of course is not equivalent to the color signals being transmitted by broadcast stations. Many hues are oversaturated. Also, the chroma phase angle is normally produced by using a carrier that is offset enough from 3.58 MHz so that 360° phase shift occurs during each horizontal line. This produces a gated rainbow pattern rather than specific, phase controlled colors.

CONTROLS AND INDICATORS

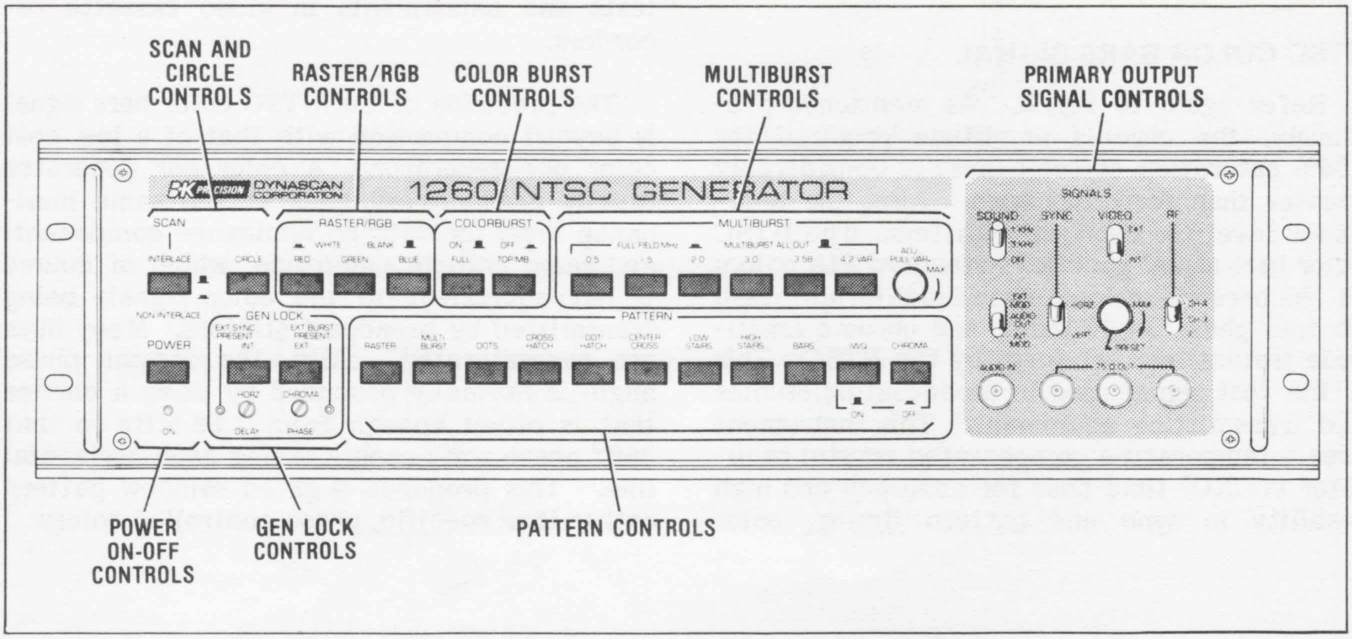


Fig. 5. Functional Grouping of Front Panel Controls and Indicators.

FUNCTIONAL GROUPING

Fig. 5 and 6 show how the operator's controls are functionally grouped for convenience and ease of operation. Although this extremely versatile, sophisticated instrument has over 60 operator controls and jacks, the layout and identification of the controls simplify operation. All functionally related controls are grouped in clusters and identified to eliminate most operator errors.

POWER ON-OFF CONTROLS (see Fig. 7)

1. **POWER Switch.** Latching type pushbutton switch; push to engage and latch, push again to release. Engage to turn on power. Release to turn off power.
2. **Pilot Light.** Lights when unit is operating.

GEN LOCK CONTROLS (See Fig. 8)

The INT and EXT switches (items 3 and 4) are mechanically interlocking pushbutton switches. Pushing INT releases EXT, and vice versa.

3. **INT Switch.** Selects internal sync.
4. **EXT Switch.** Selects external sync. Sync generator locks to external composite video signal applied at GEN LOCK input jack on rear panel.
5. **EXT SYNC PRESENT Indicator.** Lights when adequate external sync input is present for external gen lock operation.
6. **EXT BURST PRESENT Indicator.** Lights when adequate external color burst signal is present for external gen lock operation.
7. **HORZ DELAY Adjustment.** Permits adjustment of horizontal sync for gen lock operation. Compensates for sync delay caused by cable.
8. **CHROMA PHASE Adjustment.** Permits adjustment of chroma phase (frequency) to match external signal for gen lock operation.

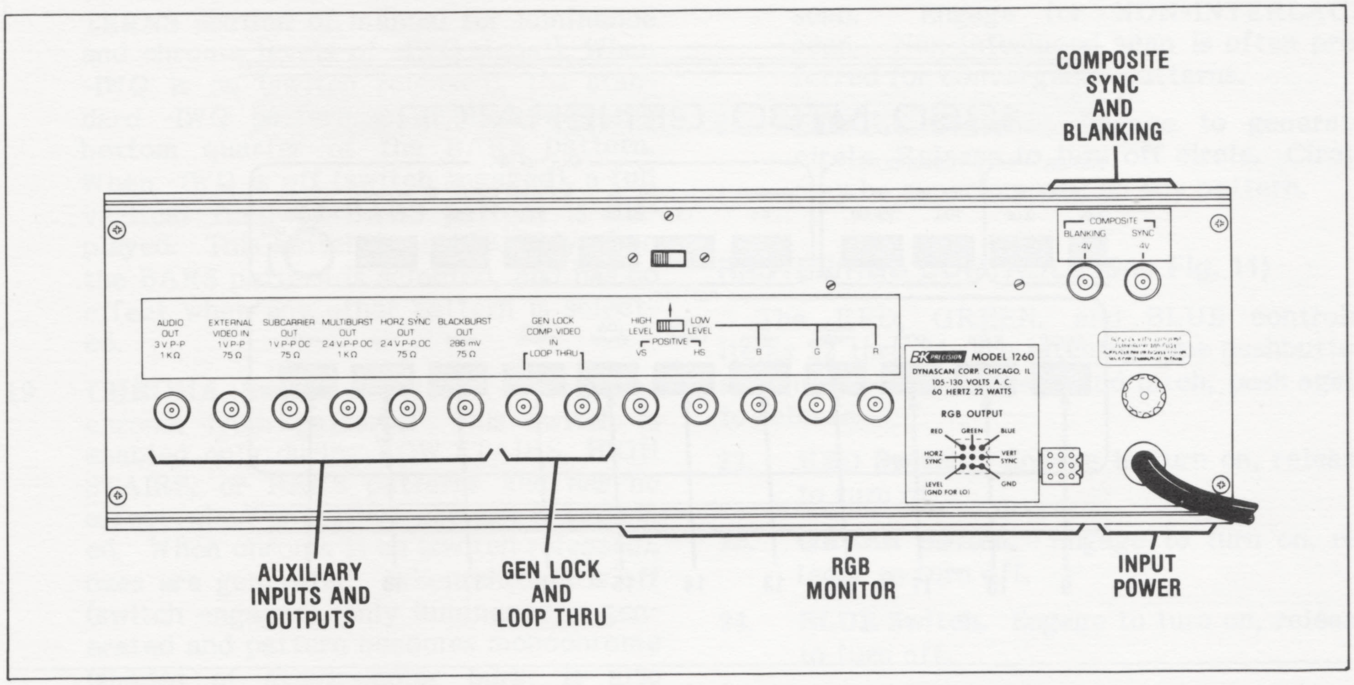


Fig. 6. Functional Grouping of Rear Panel Controls and Indicators.

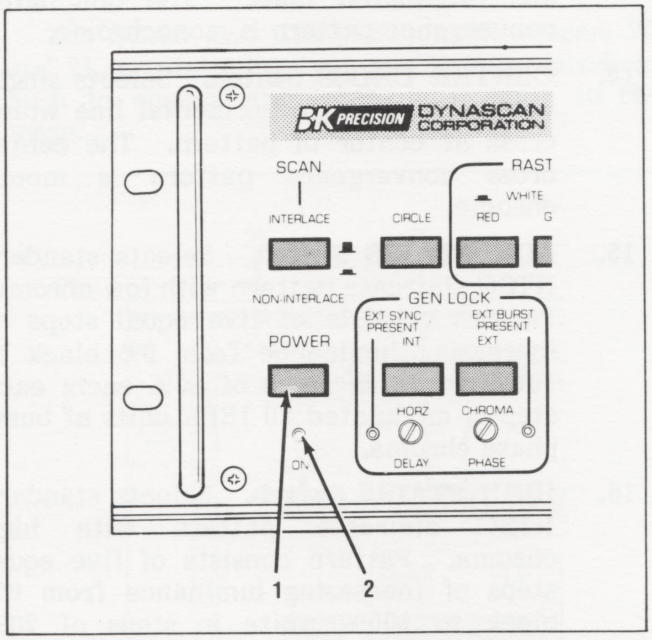


Fig. 7. POWER On-Off Controls.

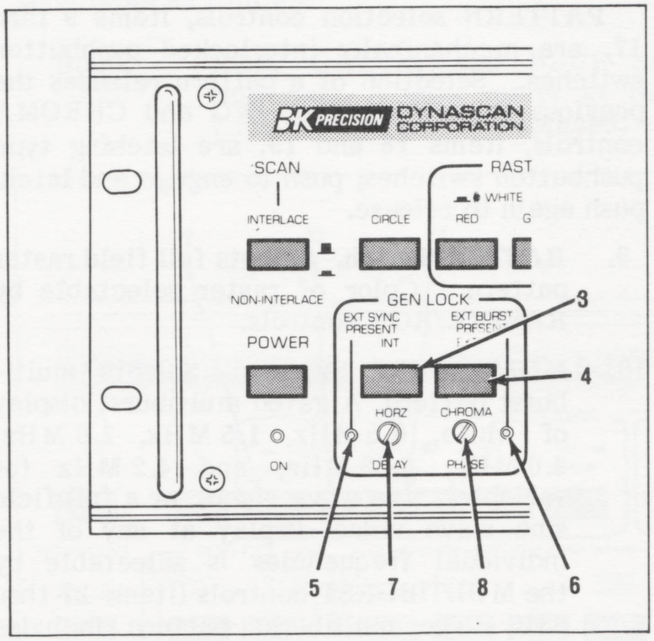


Fig. 8. GEN LOCK Controls.

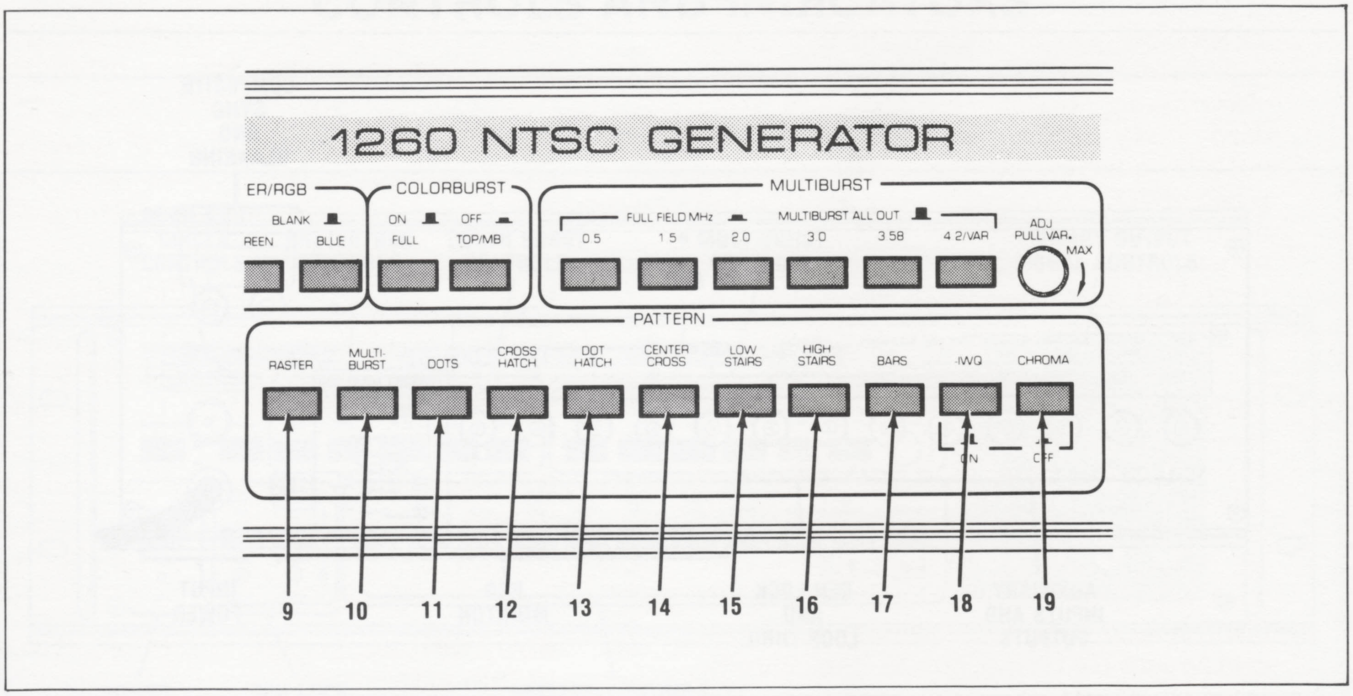


Fig. 9. Pattern Controls.

PATTERN CONTROLS (See Fig. 9)

PATTERN selection controls, items 9 thru 17, are mechanically interlocked pushbutton switches. Selection of a pattern releases the previous selection. The -IWG and CHROMA controls, items 18 and 19, are latching type pushbutton switches; push to engage and latch, push again to release.

9. **RASTER Switch.** Selects full field raster pattern. Color of raster selectable by RASTER/RGB controls.

10. **MULTIBURST Switch.** Selects multiburst pattern. A gated multiburst display of white, 0.5 MHz, 1.5 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz (or variable) sine wave video, or a full field sine wave video display at any of the individual frequencies is selectable by the MULTIBURST controls (items 27 thru 33). The multiburst pattern includes color burst but no chroma.

11. **DOTS Switch.** Selects 19 x 15 dot convergence pattern. The dots pattern is monochrome; i.e, contains no color burst or chroma.

12. **CROSS HATCH Switch.** Selects 19 x 15 line convergence pattern. The cross hatch pattern is monochrome.

13. **DOT HATCH Switch.** Selects both dots and crosshatch lines. The dot hatch convergence pattern is monochrome.

14. **CENTER CROSS Switch.** Selects single vertical and single horizontal line which cross at center of pattern. The center cross convergence pattern is monochrome.

15. **LOW STAIRS Switch.** Selects standard NTSC staircase pattern with low chroma. Pattern consists of five equal steps of increasing luminance from 0% black to 100% white in steps of 20% each; each step is modulated 20 IEEE units at burst phase chroma.

16. **HIGH STAIRS Switch.** Selects standard NTSC staircase pattern with high chroma. Pattern consists of five equal steps of increasing luminance from 0% black to 100% white in steps of 20% each; each step is modulated 40 IEEE units at burst phase chroma.

17. **BARS Switch.** Selects standard NTSC color bar pattern consisting of eight color bars at luminance and chroma levels specified in Fig. 2.

18. **-IWQ Switch.** Selects or removes standard -IWQ pattern from bottom quarter

of BARS pattern vertical scan (See PATTERNS section of manual for luminance and chroma levels of -IWQ signal). When -IWQ is on (switch released), the standard -IWQ pattern is displayed on the bottom quarter of the BARS pattern. When -IWQ is off (switch engaged), a full vertical field of BARS pattern is displayed. This switch is enabled only when the BARS pattern is selected, and has no effect when any other pattern is selected.

19. **CHROMA Switch.** Selects or removes chroma from pattern. This switch is enabled only during LOW STAIRS, HIGH STAIRS, or BARS patterns and has no effect when any other pattern is selected. When chroma is on (switch released), hues are generated. When chroma is off (switch engaged), only luminance is generated and pattern becomes monochrome (shades of gray); color burst is also removed.

SCAN AND CIRCLE CONTROLS (See Fig. 10)

The SCAN and CIRCLE controls, items 20 and 21, are latching type pushbutton switches; push to engage and latch, push again to release.

20. **SCAN Switch.** Release for INTERLACE scan. Engage for NON-INTERLACE scan. Non-interlaced scan is often preferred for convergence patterns.

21. **CIRCLE Switch.** Engage to generate circle. Release to turn off circle. Circle may be superimposed on any pattern.

RASTER/RGB CONTROLS (See Fig. 11)

The RED, GREEN, and BLUE controls, items 22 thru 24, are latching type pushbutton switches; push to engage and latch, push again to release.

22. **RED Switch.** Engage to turn on, release to turn off.

23. **GREEN Switch.** Engage to turn on, release to turn off.

24. **BLUE Switch.** Engage to turn on, release to turn off.

The RED, GREEN, and BLUE switches control the raster color when the RASTER pattern is selected. Eight raster colors are selectable as follows:

Blank	RED, GREEN, and BLUE all released. A dark raster at the 7.5% set-up level is displayed.

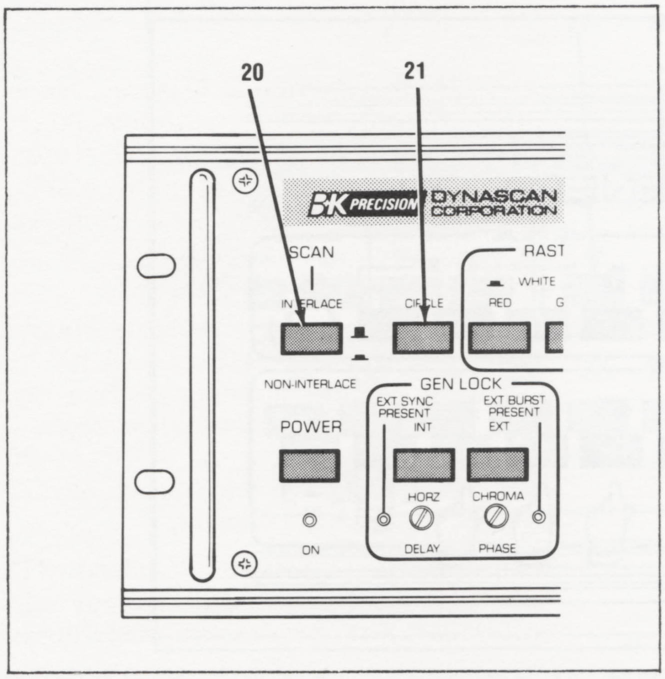


Fig. 10. Scan and Circle Controls.

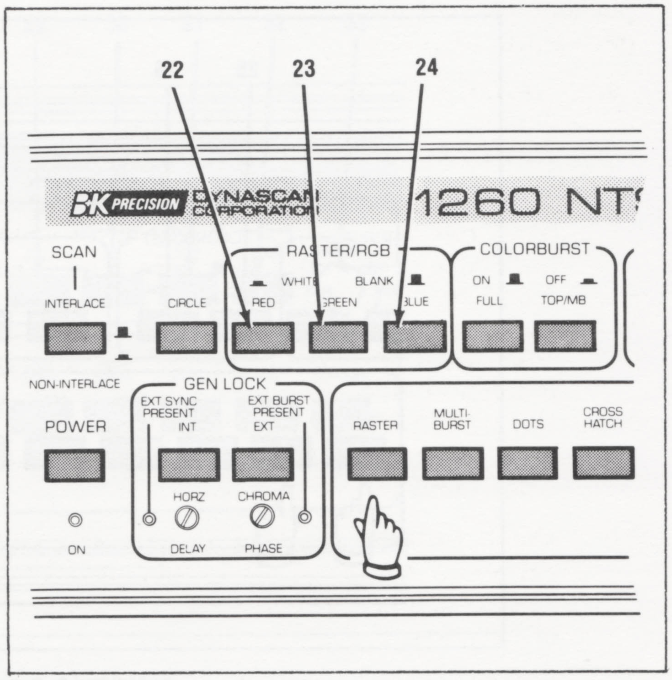


Fig. 11. Raster/RGB Controls.

White	RED, GREEN, and BLUE all engaged. A 75% white raster is displayed.
Red	Only RED engaged. A 100% saturated red raster is displayed.
Green	Only GREEN engaged. A 100% saturated green raster is displayed.
Blue	Only BLUE engaged. A 100% saturated blue raster is displayed.
Yellow	RED and GREEN engaged. A 100% saturated yellow raster is displayed.
Cyan	BLUE and GREEN engaged. A 100% saturated cyan raster is displayed.
Magenta	RED and BLUE engaged. A 100% saturated magenta raster is displayed.

The RED, GREEN, and BLUE switches also act as enable/disable switches for the respective R, G, and B outputs on the rear panel for all patterns except NTSC color bars. When a color monitor with separate R, G, and B inputs is connected to the rear panel, convergence, multiburst, staircase, raster, and circle patterns may be generated in color on the RGB monitor (color bar patterns are not intended for use with RGB color monitors). Pattern colors of red, green, blue, yellow, cyan, magenta, or white are selectable by the RED, GREEN, and BLUE switches by using the switches singly or in combination as previously described for raster color selection.

COLOR BURST CONTROLS (See Fig. 12)

The FULL and TOP/MB controls, items 25 and 26, are latching type pushbutton switches; push to engage and latch, push again to release.

25. **FULL Switch.** Release to turn on color burst, engage to turn off color burst. On LOW STAIRS, HIGH STAIRS or BARS pattern, selects or removes 3.58 MHz color burst from **full** vertical scan. No effect on other patterns.

26. **TOP/MB Switch.** Release to turn on color burst, engage to turn off color burst. On RASTER, LOW STAIRS, HIGH STAIRS or BARS pattern, selects or removes 3.58 MHz color burst from **top** quarter of vertical scan. On MULTIBURST pattern, selects or removes color burst from **full** vertical scan. No effect on other patterns.

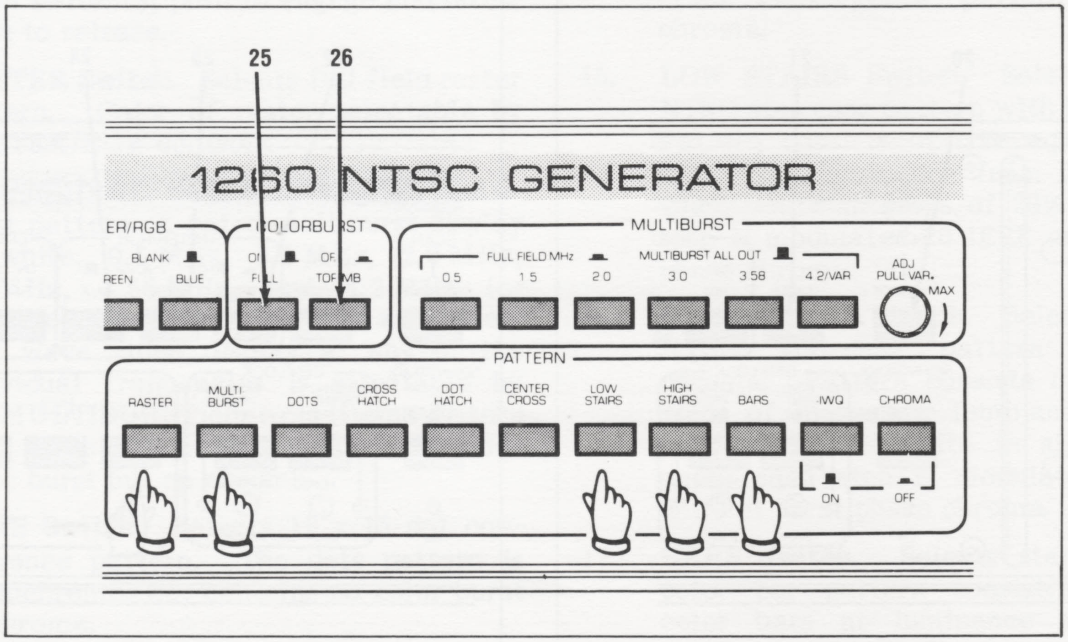


Fig. 12. Color Burst Controls.

MULTIBURST CONTROLS (See Fig. 13)

When the MULTIBURST pattern is selected, these controls select the specific type of multiburst pattern generated. When other patterns are selected, these controls select the frequency at the MULTIBURST OUT jack on the rear panel. The six pushbutton switches are mechanically interlocked so that only one may be selected at a given time (all may be released by partially depressing any button of the group that is not engaged). Each switch selects a FULL FIELD of sine wave video at the stated frequency, in MHz, when engaged. A gated multiburst pattern is selected when all six pushbuttons are released (ALL OUT).

27. **0.5 Switch.** Selects full field of 0.5 MHz sine wave video.

28. **1.5 Switch.** Selects full field of 1.5 MHz sine wave video.

29. **2.0 Switch.** Selects full field of 2.0 MHz sine wave video.

30. **3.0 Switch.** Selects full field of 3.0 MHz sine wave video.

31. **3.58 Switch.** Selects full field of 3.58 MHz sine wave video.

32. **4.2/VAR Switch.** Selects full field of 4.2 MHz sine wave video. 4.2 MHz signal is replaced with variable frequency signal when ADJ/PULL VAR knob is pulled out; frequency is varied by rotation of ADJ/PULL VAR knob.

33. **ADJ/PULL VAR Control.** Combination push-pull switch and rotary control.

Push-Pull Switch:

When pushed in, last burst of gated multiburst pattern is fixed frequency of 4.2 MHz, or 4.2/VAR switch selects full field of fixed frequency 4.2 MHz video.

When pulled out, last burst of gated multiburst pattern becomes variable frequency, or 4.2/VAR switch selects full field of variable frequency video. Frequency is adjustable by rotation of control.

Rotary Control:

Rotation of control varies video frequency from at least 2 MHz to 7 MHz when variable frequency multiburst operation is selected; clockwise rotation increases frequency.

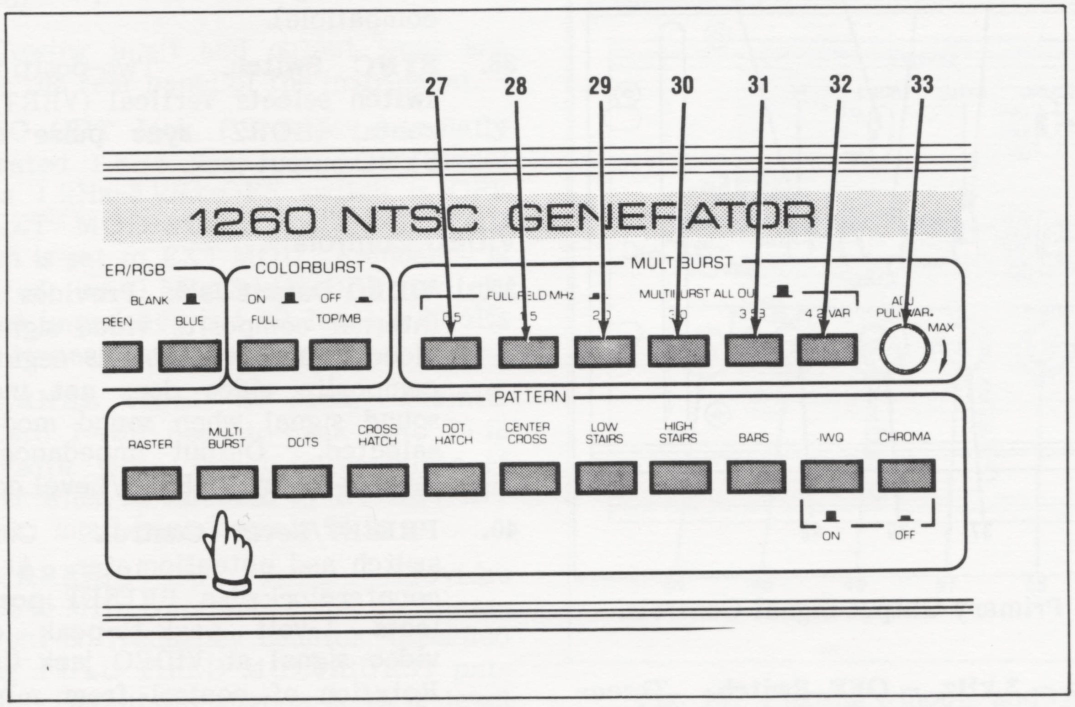


Fig. 13. Multiburst Controls.

PRIMARY OUTPUT SIGNAL CONTROLS (See Fig. 14)

SOUND Controls

34. **EXT MOD - AUDIO OUT - INT MOD Switch.** Three-position toggle switch selects sound mode as follows:

    EXT MOD. RF output is modulated with 4.5 MHz sound intercarrier that is frequency modulated by external audio signal applied at AUDIO IN jack. Internally generated audio not available at rear panel AUDIO OUT jack.

    AUDIO OUT. RF output is not modulated with sound. Internally generated audio is still available at rear panel AUDIO OUT jack.

    INT MOD. RF output is modulated with 4.5 MHz sound intercarrier that is frequency modulated by internal audio generator. Frequency is selected by 1 kHz-3 kHz-OFF switch. Internally generated audio is still available at rear panel AUDIO OUT jack.

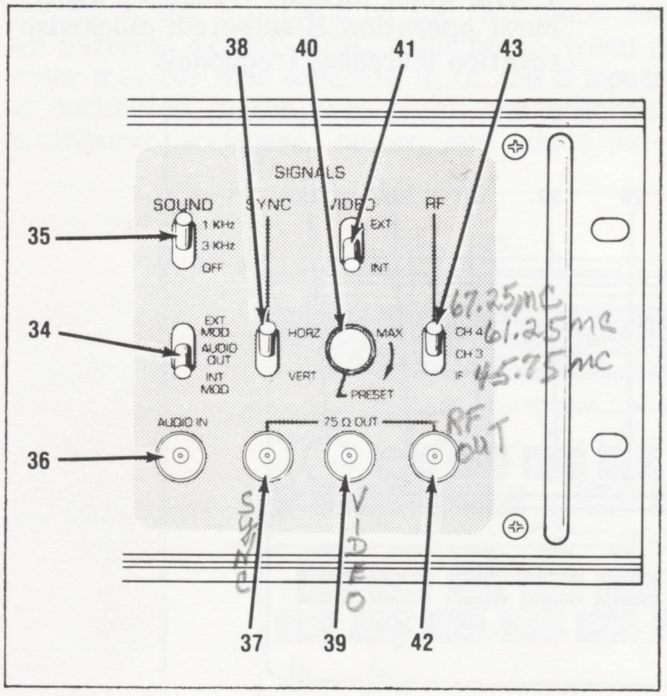


Fig. 14. Primary Output Signal Controls.

35. **1 kHz - 3 kHz - OFF Switch.** Three-position toggle switch controls operation of internal audio generator as follows:

    1 kHz. Selects 1 kHz audio tone.

    3 kHz. Selects 3 kHz audio tone.

    OFF. Turns off internal audio generator.

    Internally generated 1 kHz or 3 kHz audio is available at the rear panel AUDIO OUT jack, except when this switch is OFF or the EXT MOD-AUDIO OUT-INT MOD switch is set to EXT MOD.

36. **AUDIO IN Jack.** Permits external audio signal to modulate the 4.5 MHz sound intercarrier when EXT MOD sound mode is selected. External signal must be within 100 Hz to 10 kHz at 1 to 3 volts peak-to-peak. Input impedance is 10 kΩ. External audio is coupled through 75 µs pre-emphasis network.

SYNC Controls

37. **SYNC Output Jack.** Provides horizontal or vertical sync pulse, as selected by SYNC switch, for external use such as sync trigger for an oscilloscope. Sync pulse is negative polarity. Output impedance is 75 Ω, level is 2.4 volts peak-to-peak or greater into open circuit (TTL compatible).

38. **SYNC Switch.** Two-position toggle switch selects vertical (VERT) or horizontal (HORZ) sync pulse output at SYNC output jack.

VIDEO Controls

39. **VIDEO Output Jack.** Provides continuous internal composite video signal output; video is positive, sync is negative. The composite video does not include the sound signal when sound modulation is selected. Output impedance is 75 Ω, level is set by PRESET/Level control.

40. **PRESET/Level Control.** Combination switch and potentiometer. At the fully counterclockwise PRESET position, selects 1-volt peak-to-peak composite video signal at VIDEO jack (into 75 Ω). Rotation of control from minimum to MAX adjust amplitude from 0 to 1.5-volt peak-to-peak (into 75 Ω).

41. **EXT-INT Switch.** Two-position toggle switch selects rf modulation source:

EXT. RF output is modulated by external composite video applied at rear panel EXTERNAL VIDEO IN jack. Internal composite video continues to be available at VIDEO output jack.

INT. RF output is modulated by internally generated composite video. Internal composite video also available at VIDEO output jack.

RF Controls

42. **RF Output Jack.** Provides approximately 5 mV rms (into 75 Ω) rf envelope modulated by composite video. May also be modulated by sound, if so selected. Output impedance is 75 Ω.

43. **CH 4-CH 3-IF Switch.** Three-position toggle switch selects carrier frequency of RF output as follows:

IF = 45.75 MHz
CH 3 = 61.25 MHz
CH 4 = 67.25 MHz

AUXILIARY INPUTS AND OUTPUTS (See Fig. 15)

The following input and output jacks are mounted on the rear panel of the instrument.

44. **AUDIO OUT Jack.** Provides internally generated 1 kHz or 3 kHz audio signal unless 1 kHz-3 kHz-OFF switch is OFF or EXT MOD-AUDIO OUT-INT MOD switch is set to EXT MOD. Frequency is selected by 1 kHz-3 kHz-OFF switch. Output impedance is 1 kΩ, level is 3 volts peak-to-peak into open circuit.

45. **EXTERNAL VIDEO IN Jack.** Permits standard 1-volt peak-to-peak (into 75 Ω) composite video signal to modulate rf carrier when so selected by RF EXT-INT switch. Input impedance is 75 Ω.

46. **SUBCARRIER OUT Jack.** Provides 3.579545 MHz color subcarrier for measurement on frequency counter (disabled during FULL FIELD MULTIBURST patterns). Output impedance is 75 Ω, level is 1 volt peak-to-peak into open circuit.

47. **MULTIBURST OUT Jack.** Provides multiburst signal for external use or measurement by a frequency counter. Gated multiburst or full field multiburst frequency is selected by MULTIBURST controls. For frequency measurement, MULTIBURST pattern must be off; this permits continuous (uninterrupted by composite blanking) operation. Output impedance is 1 kΩ, level is 2.4 volts peak-to-peak or greater into open circuit.

48. **HORZ SYNC OUT Jack.** Provides continuous negative polarity horizontal sync signal. Output impedance is 75 Ω, level is 2.4 volts peak-to-peak or greater into open circuit (TTL compatible).

49. **BLACK BURST OUT Jack.** Provides continuous black burst signal; i.e., negative polarity composite sync, color burst, and black raster at 0% level. Output impedance is 75 Ω, level of sync pulse is 286 mV peak-to-peak, level of color burst is 286 mV peak-to-peak. This is the same amplitude as the sync pulse and color burst portions of the VIDEO output signal.

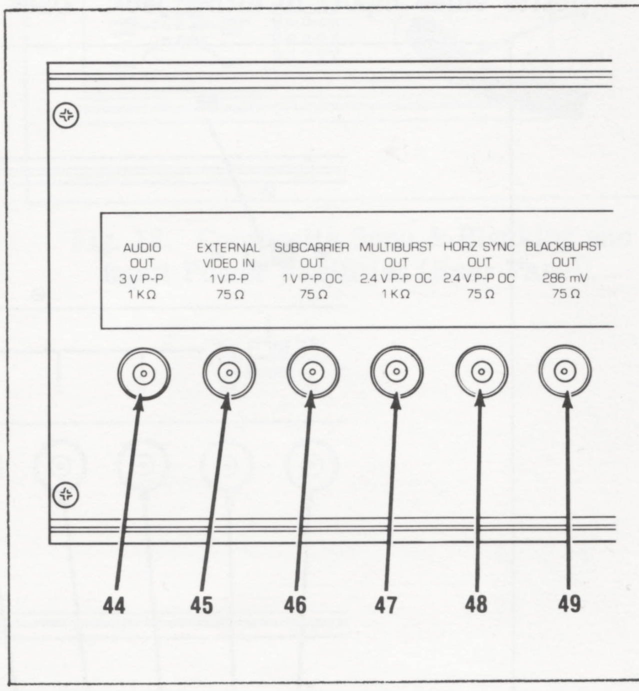


Fig. 15. Auxiliary Inputs and Outputs (Rear Panel).

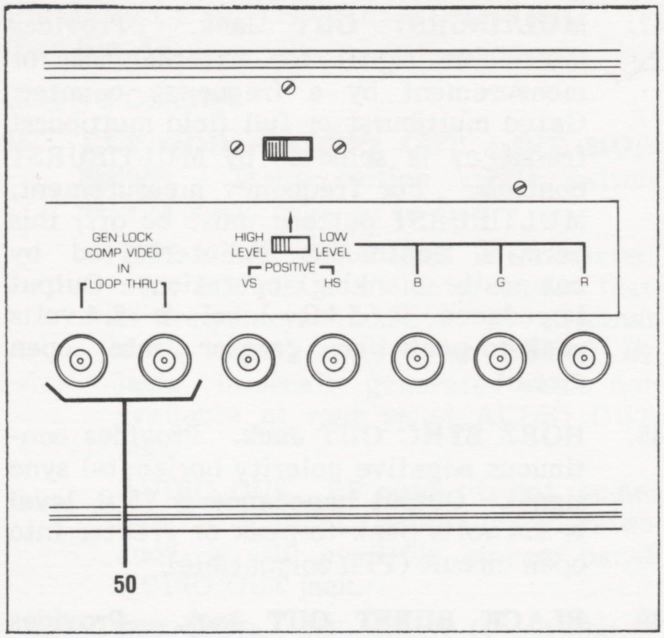


Fig. 16. GEN LOCK and LOOP THRU Jacks.

GEN LOCK AND LOOP THRU (See Fig. 16)

50. **GEN LOCK and LOOP THRU Jacks.** Pair of parallel BNC jacks, either of which may be used for GEN LOCK input or LOOP THRU output. For gen lock operation, apply COMP VIDEO IN (composite video input) to either jack. Uses standard 75 Ω, 1-volt peak-to-peak composite video input with negative sync polarity. Other jack may be used as LOOP THRU output, permitting three or more units to be gen locked to the same source.

RGB MONITOR OUTPUTS AND CONTROLS (See Fig. 17)

The following jacks provide independent red, bule, and green output signals, along with positive polarity vertical and horizontal sync signals for application to 525 line color monitors. These controls permit convergence, raster, multiburst, staircase, and circle patterns to be displayed on color monitors in any of the eight raster color combination (color bars pattern not intended for RGB color monitors). These controls are mounted on the rear panel of the instrument.

51. **VS Jack.** Provides continuous positive polarity vertical sync pulses. TTL compatible output; level is 2.4 volts peak-to-peak or greater into open circuit.

52. **HS Jack.** Provides continuous positive polarity horizontal sync pulses. TTL compatible, level is 2.4 volts peak-to-peak or greater into open circuit.

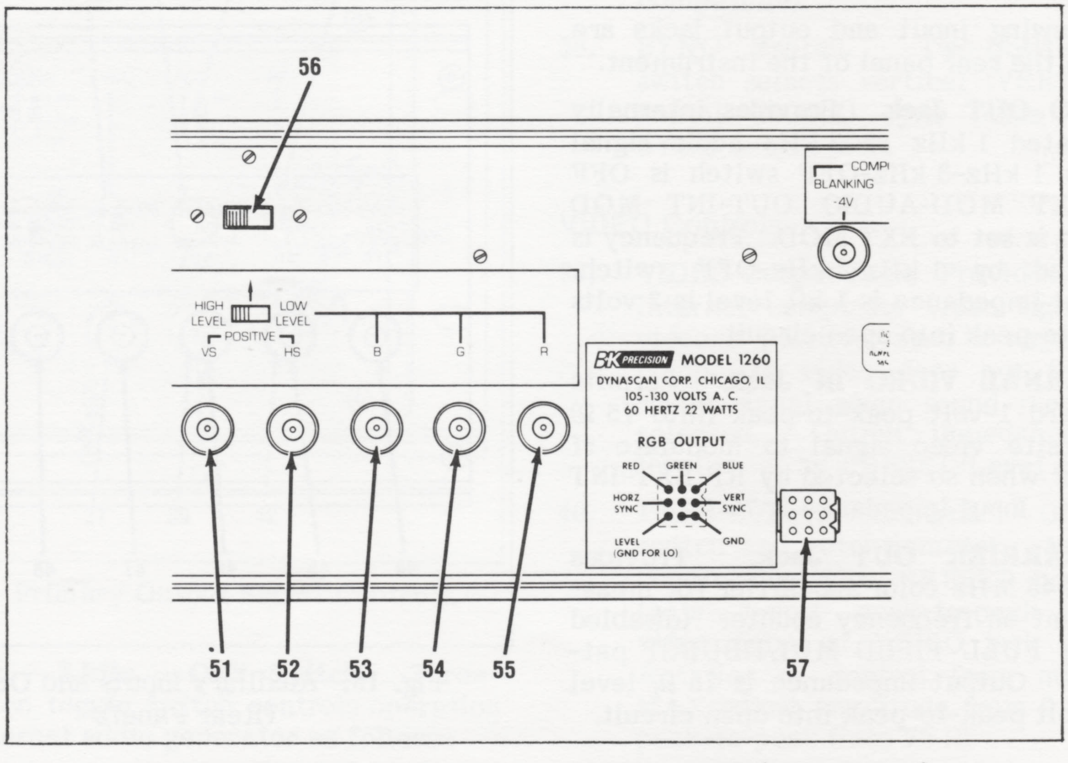


Fig. 17. RGB Monitor Outputs and Controls (Rear Panel).

53. **B Jack.** Provides blue output signal. The BLUE switch on the front panel acts as an enable-disable switch. When enabled, the blue signal is gated on and off by the specific pattern selected.

54. **G Jack.** Provides green output signal. The GREEN switch on the front panel acts as an enable-disable switch. When enabled, the green signal is gated on and off by the specific pattern selected.

55. **R Jack.** Provides red output signal. The RED switch on the front panel acts as an enable-disable switch. When enabled, the red signal is gated on and off by the specific pattern selected.

56. **HIGH LEVEL-LOW LEVEL Switch.** Selects high or low level output for R, G, and B outputs. Low level is approximately 1 volt peak-to-peak, high level is TTL compatible 2.4 volts or greater peak-to-peak. Use low level only for staircase patterns.

57. **RGB OUTPUT Receptacle.** Duplicates VS, HS, R, G, and B outputs on 9-pin connector (wired as shown in Fig. 17). Mates with plug on many RGB monitors; permits single connector hook-up. Also permits external control of level; ground LEVEL pin for low level output, unground for high level output.

COMPOSITE SYNC AND BLANKING (See Fig. 18)

58. **COMPOSITE BLANKING Jack.** Provides continuous negative polarity composite blanking output. Output impedance is 75 Ω, level is 4 volts peak-to-peak into 75 Ω.

59. **COMPOSITE SYNC Jack.** Provides continuous negative polarity composite sync output. Output impedance is 75 Ω, level is 4 volts peak-to-peak into 75 Ω.

INPUT POWER FACILITIES (See Fig. 18)

60. **Fuse.**

61. **AC Power Cord.**

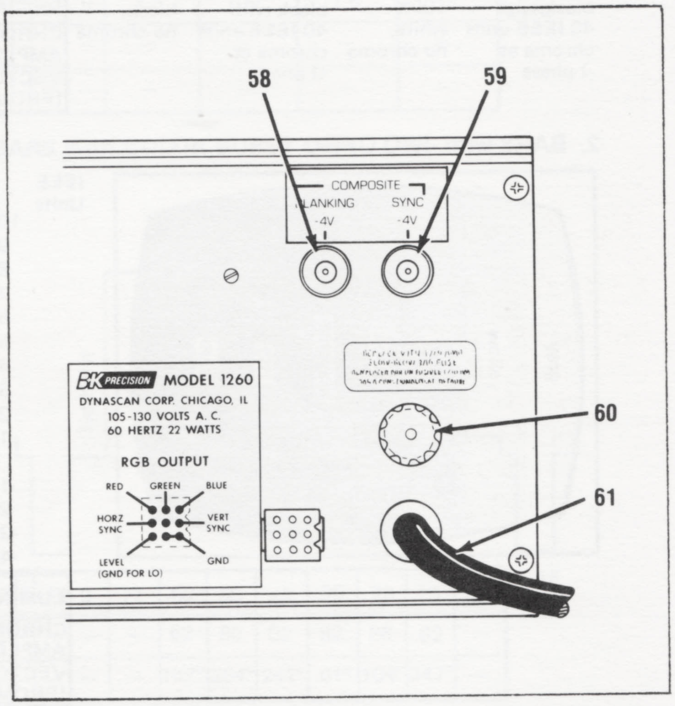
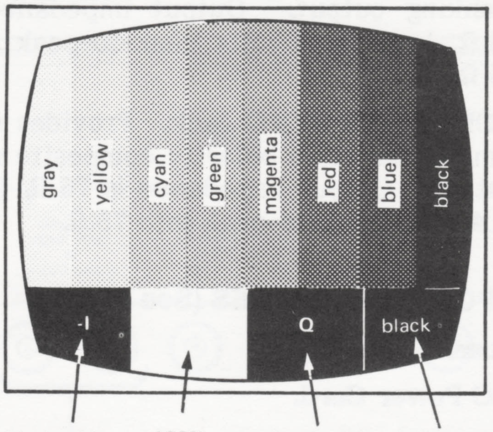


Fig. 18. Composite Sync & Blanking and Input Power Facilities (Rear Panel).

PATTERN

WAVEFORM
(1 horizontal line of pattern)

1. BARS (Standard NTSC color bars)



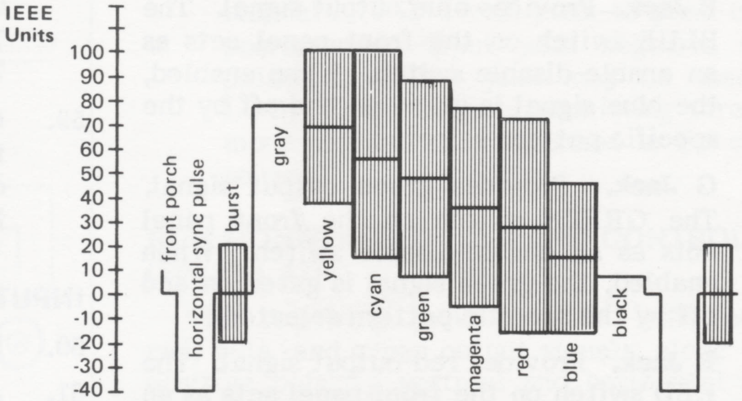
black with 40 IEEE units chroma at -I phase

100% white, no chroma

black with 40 IEEE units chroma at Q phase

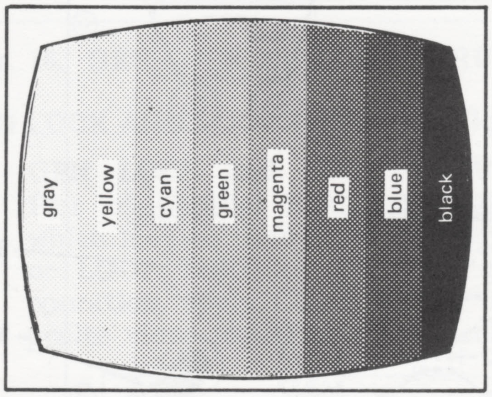
black, no chroma

A. BARS

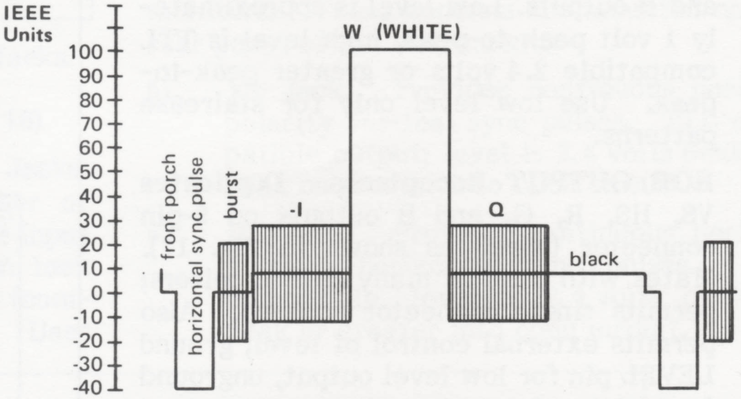


LUMINANCE	0	-40	0	77	69	56	48	36	28	15	7.5	IEEE Units
CHROMA AMPLITUDE	—	—	40	—	62	88	82	82	88	62	—	
VECTOR (FROM B-Y)	—	—	180°	—	167°	284°	241°	61°	104°	347°	—	

2. BARS with -IWQ OFF

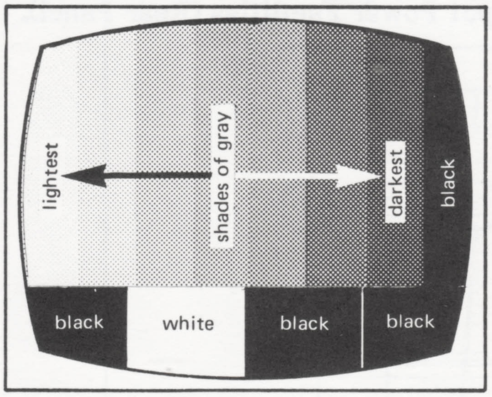


B. -IWQ

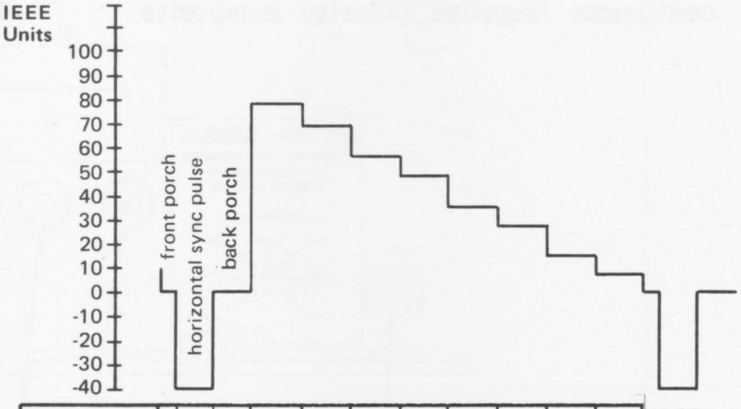


LUMINANCE	0	-40	0	7.5	100	7.5	7.5	IEEE Units
CHROMA AMPLITUDE	—	—	40	40	—	40	—	
VECTOR (FROM B-Y)	—	—	180°	303°	—	33°	—	

3. BARS with CHROMA OFF



C. BARS with CHROMA OFF



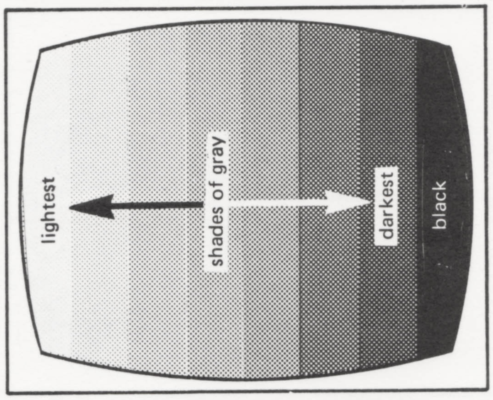
LUMINANCE	0	-40	0	77	69	56	48	36	28	15	7.5	IEEE Units
CHROMA AMPLITUDE	—	—	—	—	—	—	—	—	—	—	—	
VECTOR (FROM B-Y)	—	—	—	—	—	—	—	—	—	—	—	

NOTES:

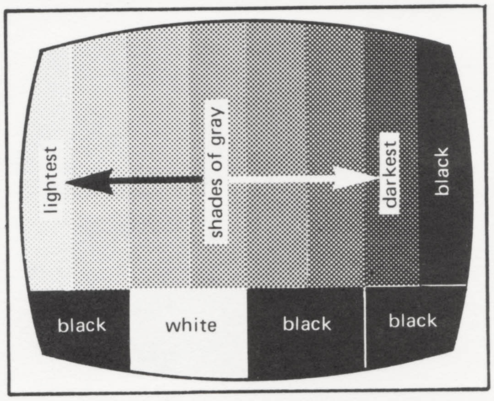
1. When pattern **1** is selected, waveform **A** is generated for top 3/4 of pattern and waveform **B** for bottom 1/4 of pattern. Waveforms **A** and **B** may be superimposed when viewing on oscilloscope.
2. When pattern **2** is selected, waveform **A** is generated.
3. When pattern **3** is selected, waveform **C** is generated for top 3/4 of pattern and waveform **D** for bottom 1/4 of pattern. Waveforms **C** and **D** may be superimposed when viewing on oscilloscope.

PATTERN

4. BARS with CHROMA and -IWQ OFF

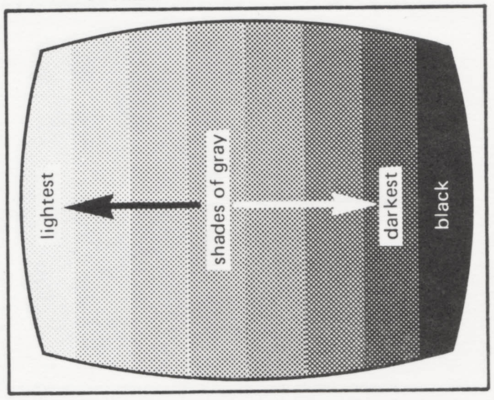


5. BARS with FULL COLOR BURST OFF



(normally same appearance as pattern 3)

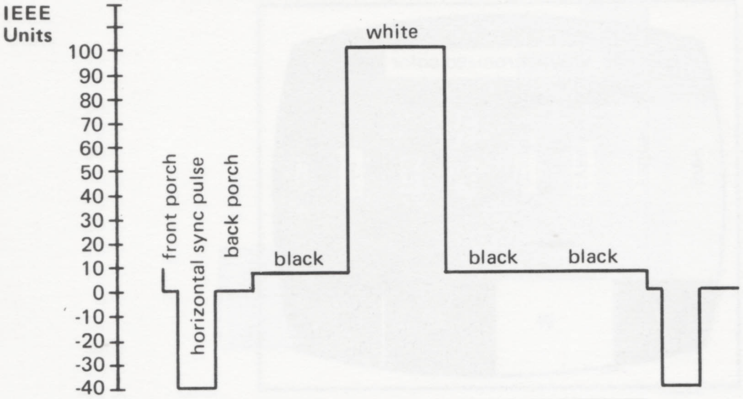
6. BARS with FULL COLOR BURST and -IWQ OFF



(normally same appearance as pattern 4)

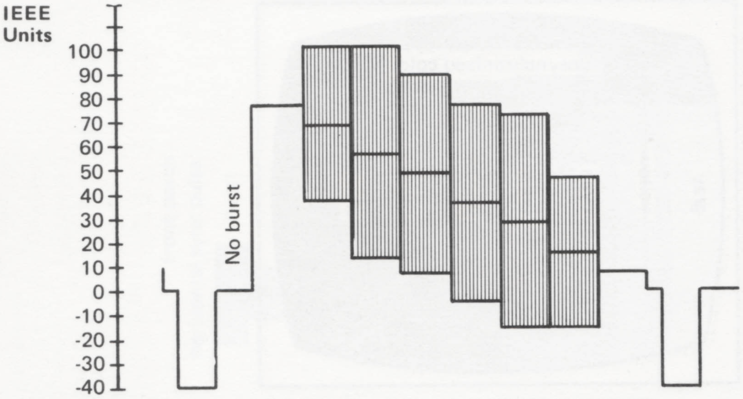
WAVEFORM
(1 horizontal line of pattern)

D. -IWQ with CHROMA OFF



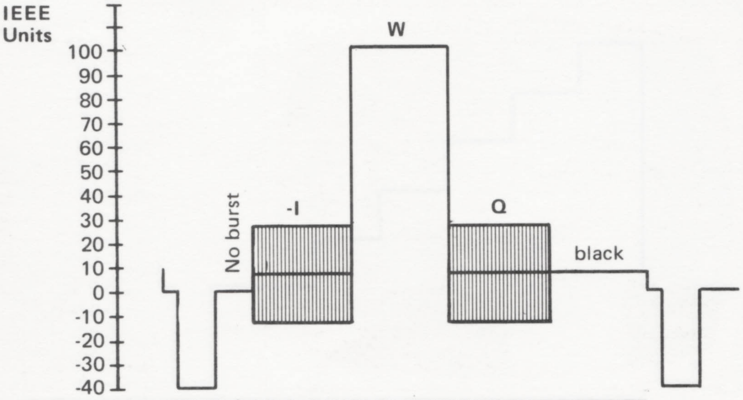
LUMINANCE	0	-40	0	7.5	100	7.5	7.5	IEEE Units
CHROMA AMPLITUDE	–	–	–	—	—	—	—	
VECTOR (FROM B-Y)	–	–	–	—	—	—	—	

E. BARS with COLOR BURST OFF



LUMINANCE	0	-40	0	77	69	56	48	36	28	15	7.5	IEEE Units
CHROMA AMPLITUDE	–	–	–	—	62	88	82	82	88	62	—	
VECTOR (FROM B-Y)	–	–	—	—	167°	284°	241°	61°	104°	347°	—	

F. -IWQ with COLOR BURST OFF



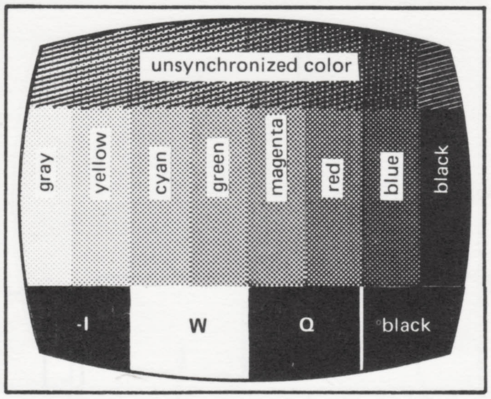
LUMINANCE	0	-40	0	7.5	100	7.5	7.5	IEEE Units
CHROMA AMPLITUDE				40		40		
VECTOR (FROM B-Y)				303°		33°		

NOTES:

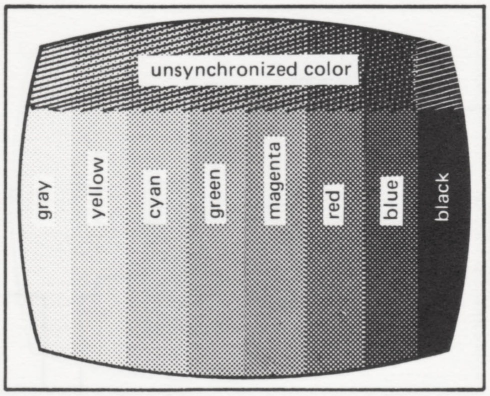
4. When pattern **4** is selected, waveform **C** is generated.
5. When pattern **5** is selected, waveform **E** is generated for top 3/4 of pattern and waveform **F** for bottom 1/4 of pattern. Waveforms **E** and **F** may be superimposed when viewing on oscilloscope.
6. When pattern **6** is selected, waveform **E** is generated.

PATTERN

7. BARS with TOP/MB COLOR BURST OFF



8. BARS with TOP/MB COLOR BURST and -IWQ OFF



On some sets, color pattern may remain synchronized with TOP/MB COLOR BURST OFF This depends upon circuit design of the television set or video monitor.

NOTES:

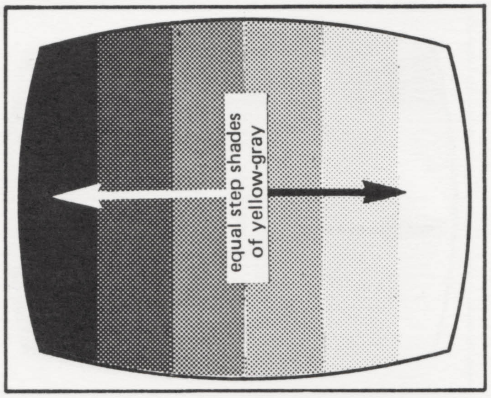
7. When pattern **7** is selected, waveform **E** is generated for top 1/4 of pattern, waveform **A** for middle 1/2 of pattern and waveform **B** for bottom 1/4 of pattern. Waveforms **E**,**A** and **B** may be superimposed when viewing on oscilloscope.
8. When pattern **8** is selected, waveform **E** is generated for top 1/4 of pattern and waveform **A** for bottom 3/4 of pattern. Waveforms **E** and **A** may be superimposed when viewing on oscilloscope.

PATTERN

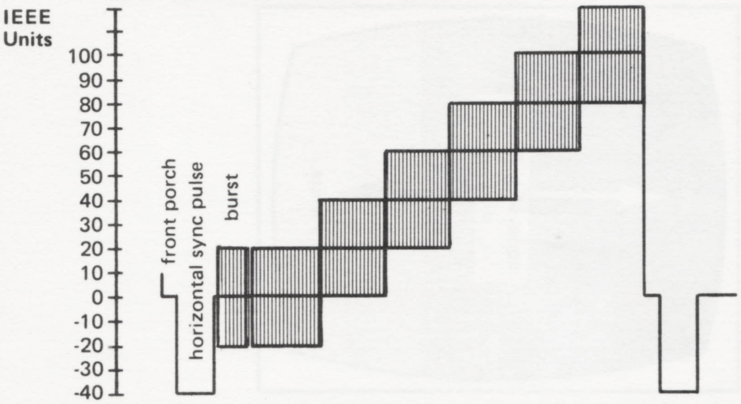
WAVEFORM

(1 horizontal line of pattern)

9. HIGH STAIRS

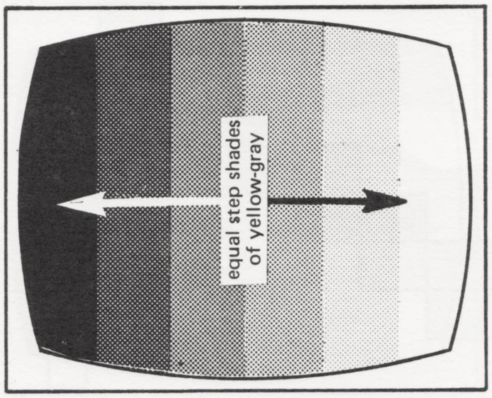


G. STAIRCASE with HIGH CHROMA



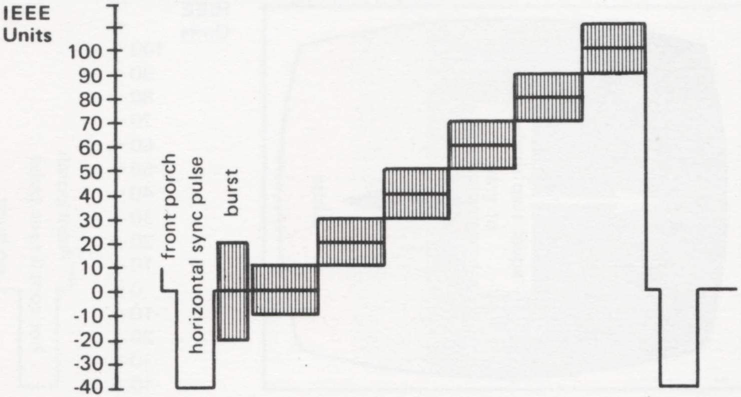
LUMINANCE	0	-40	0	0	20	40	60	80	100	IEEE Units
CHROMA AMPLITUDE	—	–	40	40	40	40	40	40	40	
VECTOR (FROM B-Y)	–	–	180°	180°	180°	180°	180°	180°	180°	

10. LOW STAIRS



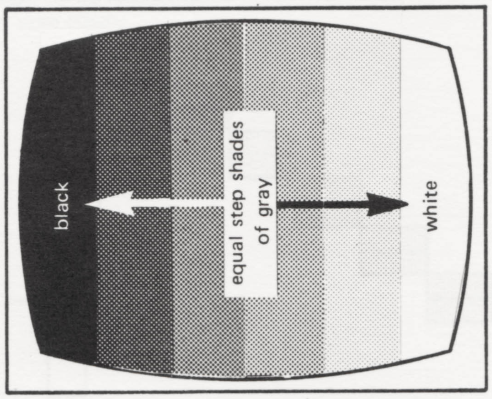
(less yellow than HIGH STAIRCASE)

H. STAIRCASE with LOW CHROMA

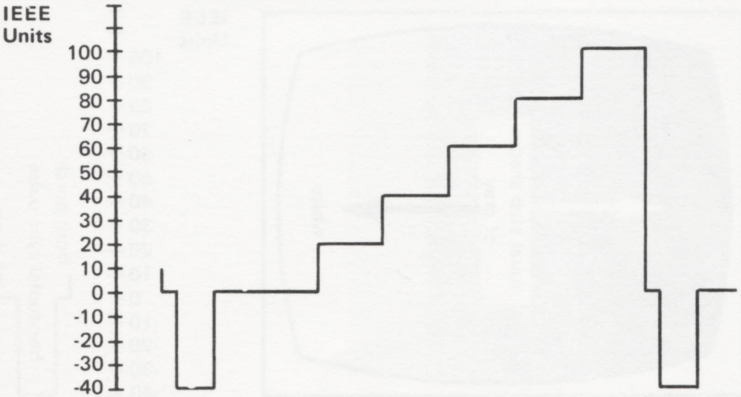


LUMINANCE	0	-40	0	0	20	40	60	80	100	IEEE Units
CHROMA AMPLITUDE	—	–	40	20	20	20	20	20	20	
VECTOR (FROM B-Y)	–	–	180°	180°	180°	180°	180°	180°	180°	

11. HIGH STAIRS with CHROMA OFF



J. STAIRCASE with CHROMA OFF



LUMINANCE	0	-40	0	0	20	40	60	80	100	IEEE Units
CHROMA AMPLITUDE	—	–	–	–	–	—	–	—	—	
VECTOR (FROM B-Y)	–	–	–	–	–	—	–	–	–	

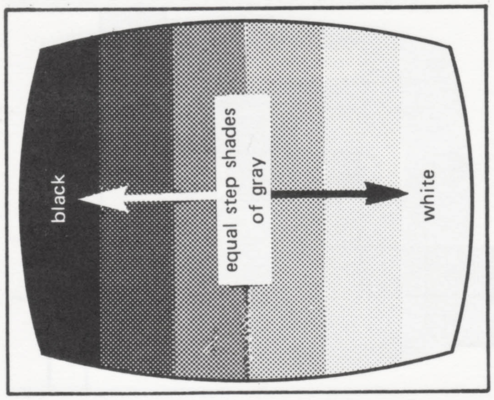
NOTES:

9. When pattern **9** is selected, waveform **G** is generated.
10. When pattern **10** is selected, waveform **H** is generated.
11. When pattern **11** is selected, waveform **J** is generated.

PATTERN

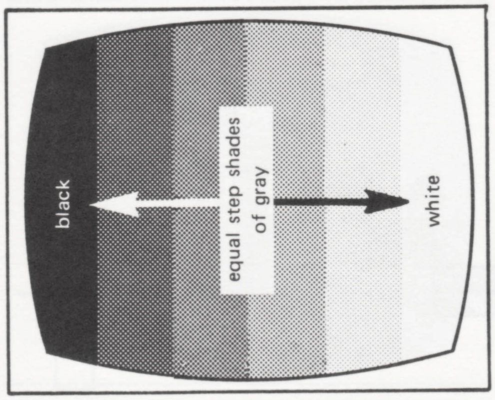
WAVEFORM
(1 horizontal line of pattern)

12. LOW STAIRS with CHROMA OFF



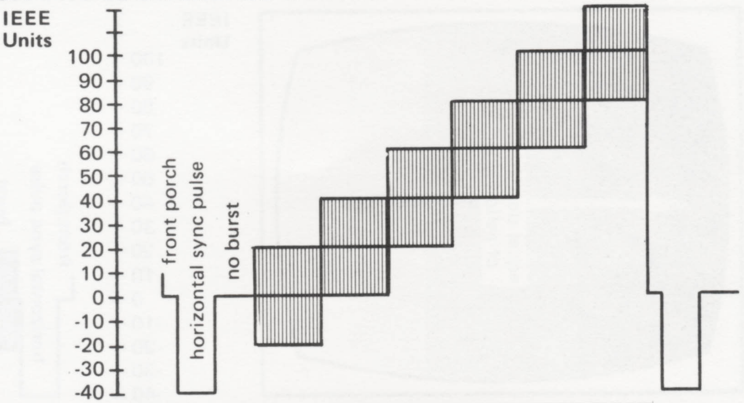
(normally same appearance as pattern 11)

13. HIGH STAIRS with FULL COLOR BURST OFF



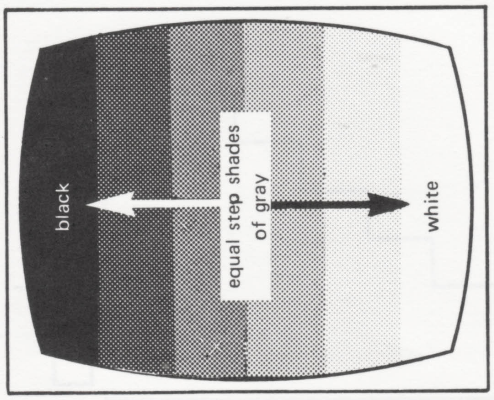
(normally same appearance as pattern 11)

K. STAIRCASE with HIGH CHROMA, COLOR BURST OFF



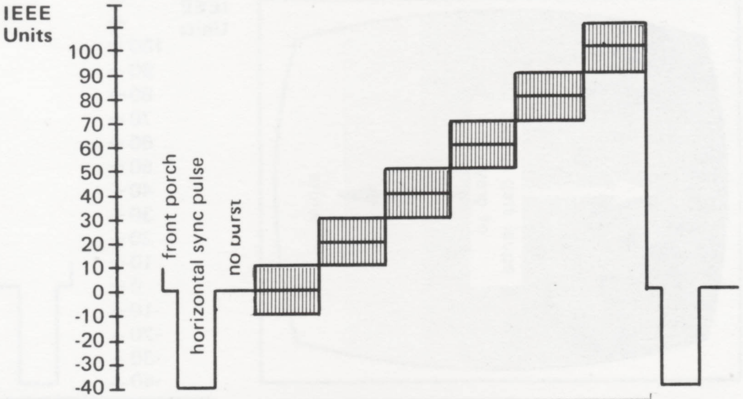
LUMINANCE	0	-40	0	0	20	40	60	80	100	IEEE Units
CHROMA AMPLITUDE	–	–	–	40	40	40	40	40	40	
VECTOR (FROM B-Y)	–	–	–	180°	180°	180°	180°	180°	180°	

14. LOW STAIRS with FULL COLOR BURST OFF



(normally same appearance as pattern 11)

L. STAIRCASE with LOW CHROMA, COLOR BURST OFF



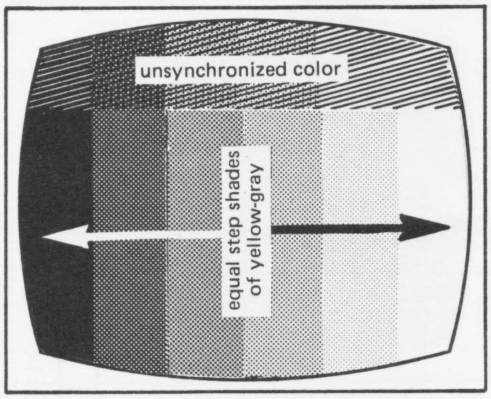
LUMINANCE	0	-40	0	0	20	40	60	80	100	IEEE Units
CHROMA AMPLITUDE	–	–	–	20	20	20	20	20	20	
VECTOR (FROM B-Y)	–	–	–	108°	180°	180°	180°	180°	180°	

NOTES:

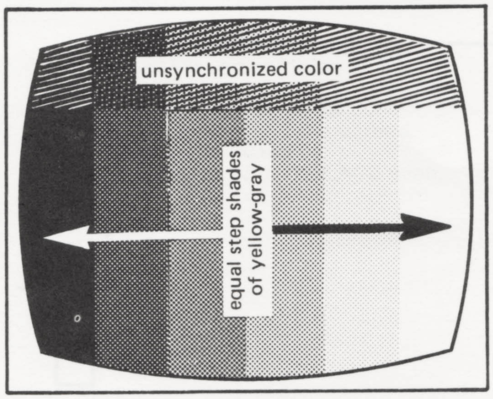
12. When pattern **12** is selected, waveform **J** is generated.
13. When pattern **13** is selected, waveform **K** is generated.
14. When pattern **14** is selected, waveform **L** is generated.

PATTERN

15. HIGH STAIRS with TOP/MB COLOR BURST OFF



16. LOW STAIRS with TOP/MB COLOR BURST OFF



(less yellow than HIGH STAIRS)

On some sets, color pattern
may remain synchronized with
TOP/MB COLOR BURST OFF.
This depends upon circuit
design of the television set
or video monitor.

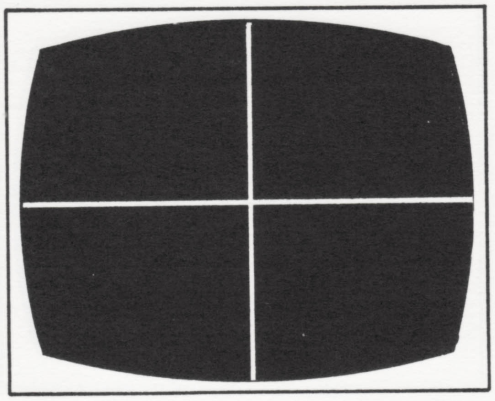
NOTES:

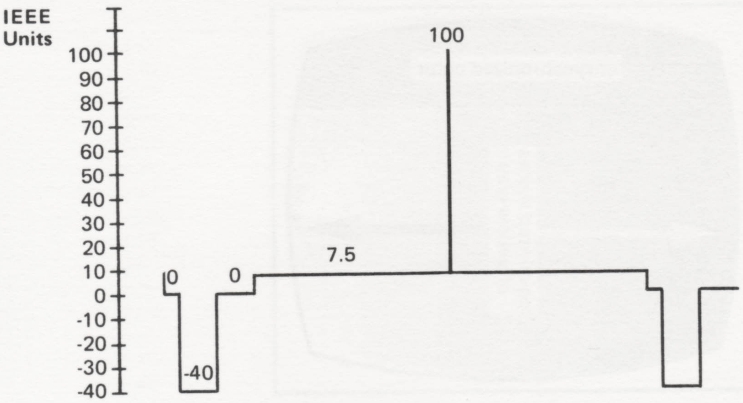
15. When pattern **15** is selected, waveform **K** is generated for top 1/4 of pattern and waveform **G** for bottom 3/4 of pattern. Waveforms **K** and **G** may be superimposed when viewing on oscilloscope.
16. When pattern **16** is selected, waveform **L** is generated for top 1/4 of pattern and waveform **H** for bottom 3/4 of pattern. Waveforms **L** and **H** may be superimposed when viewing on oscilloscope.

PATTERN

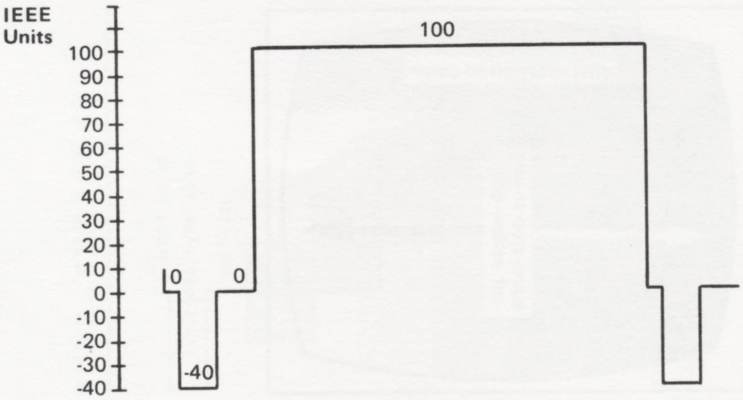
WAVEFORM
(1 horizontal line of pattern)

17. CENTER CROSS




M. All except center line

The slight vertical jitter observed in this pattern is normal for interlaced scan, which is NTSC standard. Jitter is eliminated by selecting NON INTERLACE scan.


N. Center line

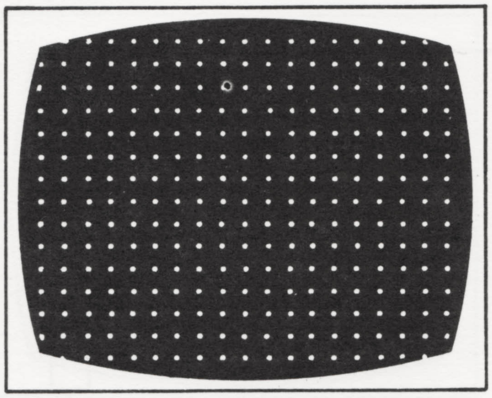
NOTES:

17. When pattern **17** is selected, waveform **M** is generated except for 1 line of waveform **N** in the center of each field.

PATTERN

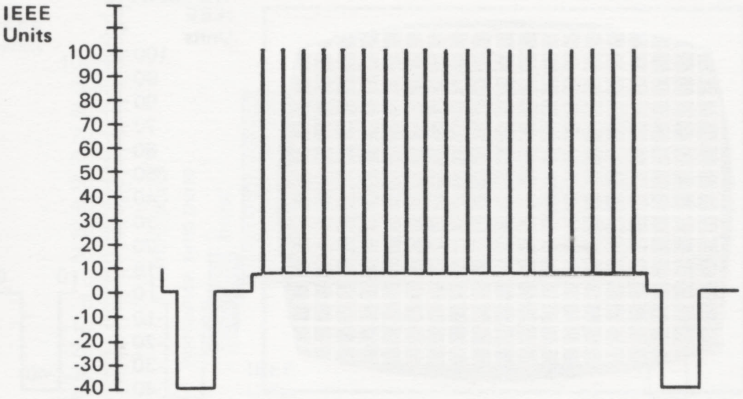
WAVEFORM
(1 horizontal line of pattern)

18. DOTS



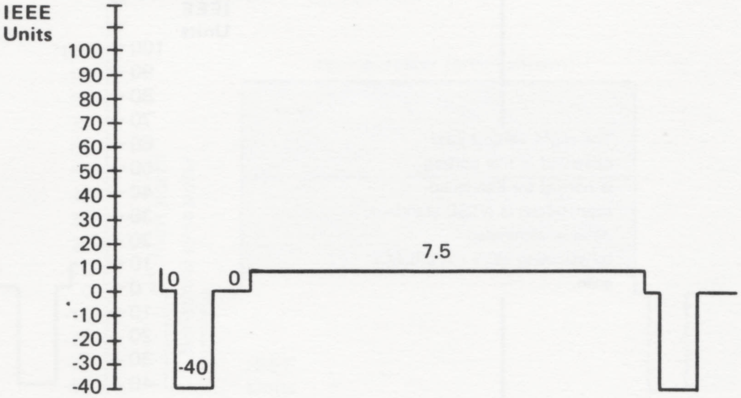
On most sets, entire pattern is not visible due to overscan.

P. Rows of dots



The slight vertical jitter observed in this pattern is normal for interlaced scan, which is NTSC standard. Jitter is eliminated by selecting NON INTERLACE scan.

Q. Between rows of dots



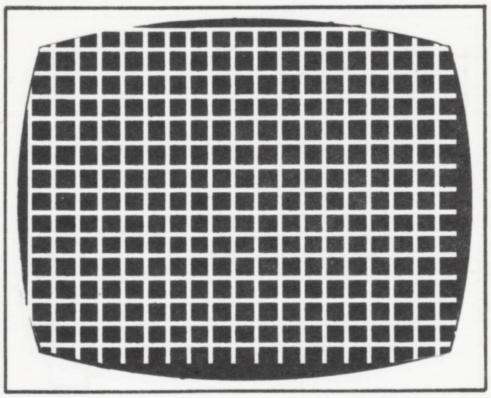
NOTES:

18. When pattern **18** is selected, waveform **P** is generated at each row of dots and waveform **Q** between rows of dots. Waveforms **P** and **Q** may be superimposed when viewing on oscilloscope.

PATTERN

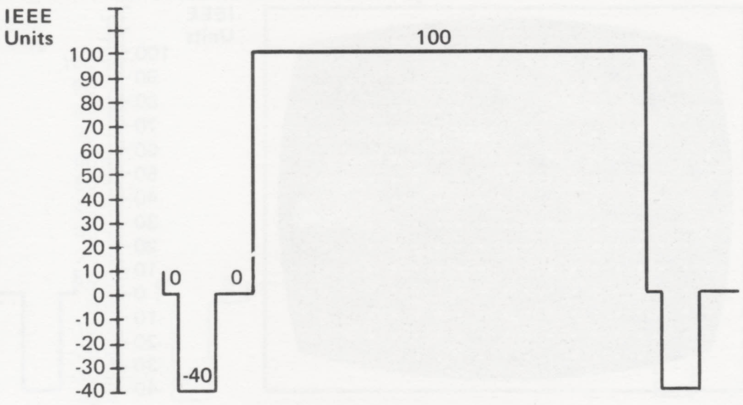
WAVEFORM
(1 horizontal line of pattern)

19. CROSSHATCH



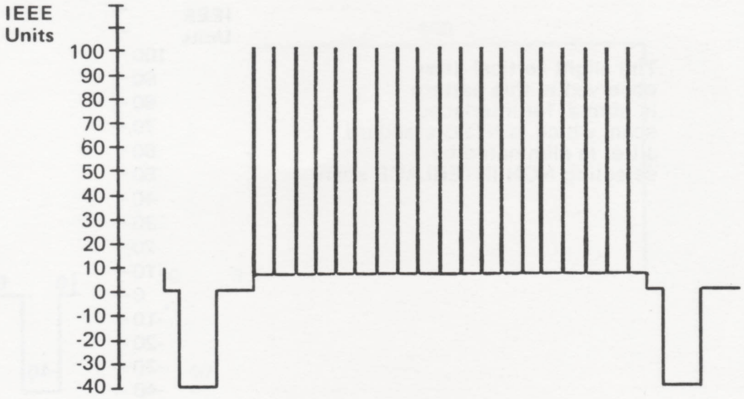
On most sets, entire pattern is not visible due to overscan.

R. White horizontal lines

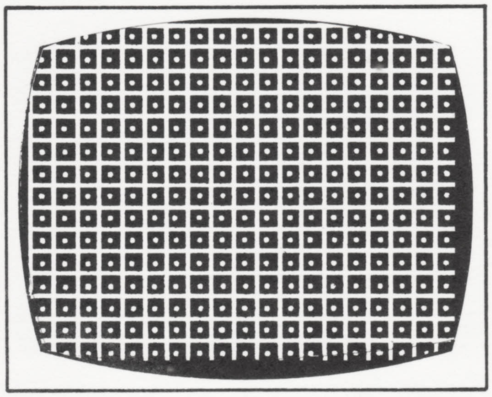


The slight vertical jitter observed in this pattern is normal for interlaced scan, which is NTSC standard. Jitter is eliminated by selecting NON INTERLACE scan.

S. Between white horizontal lines

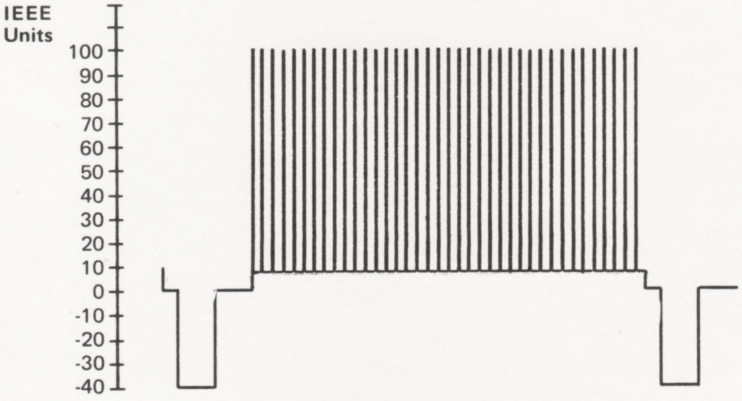


20. DOT HATCH



On most sets, entire pattern is not visible due to overscan.

T. Along row of dots with DOT HATCH pattern



NOTES:

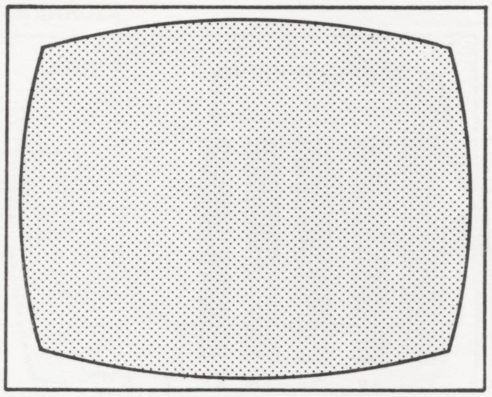
19. When pattern **19** is selected, waveform **R** is generated where each white horizontal line appears, and waveform **S** between white horizontal lines. Waveforms **R** and **S** may be superimposed when viewing on oscilloscope.
20. When pattern **20** is selected, waveform **R** is generated where each white horizontal line appears, waveform **T** where each row of dots appears and waveform **S** between white horizontal lines and rows of dots. Waveforms **R**,**T** and **S** may be superimposed when viewing on oscilloscope.

PATTERN

WAVEFORM

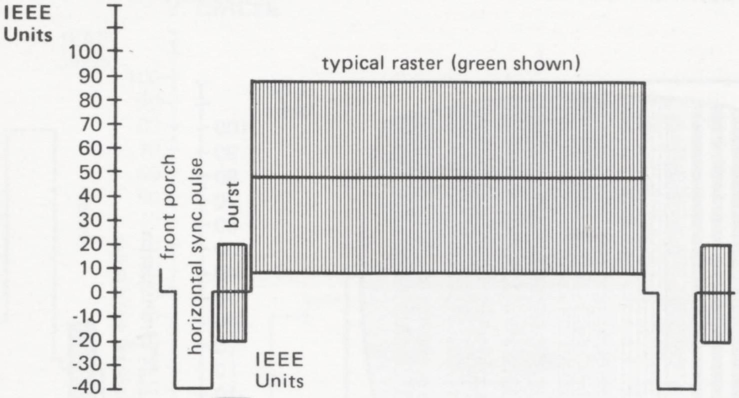
(1 horizontal line of pattern)

21. RASTER



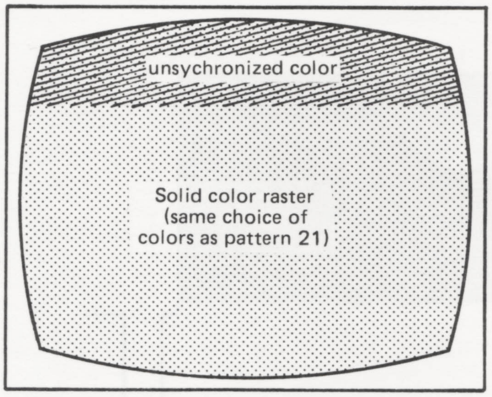
Choice of 8 single-color raster patterns. Blank, white, yellow, cyan, green, magenta, red or blue.

U. RASTER



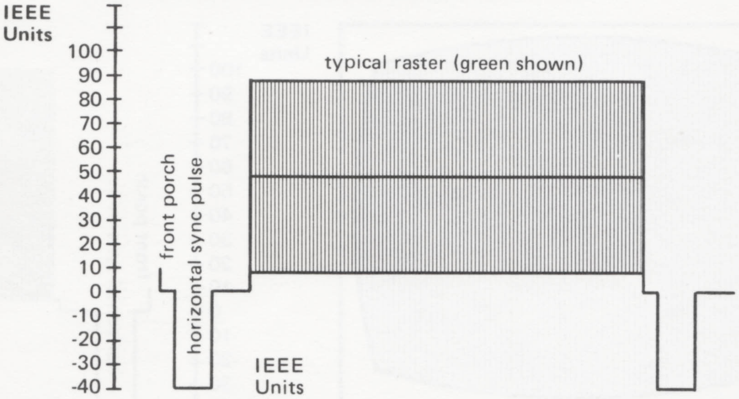
LUMINANCE	0	-40	0	blank = 7.5 white = 77	yellow = 69 cyan = 56	green = 48 magenta = 36	red = 28 blue = 15
CHROMA AMPLITUDE	–	–	40	blank = 0 white = 0	yellow = 60 cyan = 86	green = 80 magenta = 80	red = 86 blue = 60
VECTOR (FROM B-Y)	–	–	180°	blank = – white = –	yellow = 167° cyan = 284°	green = 241° magenta = 61°	red = 104° blue = 347°

22. RASTER with TOP/MB COLOR BURST OFF



On some sets, color pattern may remain synchronized with TOP/MB COLOR BURST OFF. This depends upon circuit design of the television set or monitor.

V. RASTER with COLOR BURST OFF



LUMINANCE	0	-40	0	blank = 7.5 white = 77	yellow = 69 cyan = 56	green = 48 magenta = 36	red = 28 blue = 15
CHROMA AMPLITUDE	–	–	40	blank = 0 white = 0	yellow = 60 cyan = 86	green = 80 magenta = 80	red = 86 blue = 60
VECTOR (FROM B-Y)	–	–	180°	blank = – white = –	yellow = 167° cyan = 284°	green = 241° magenta = 61°	red = 104° blue = 347°

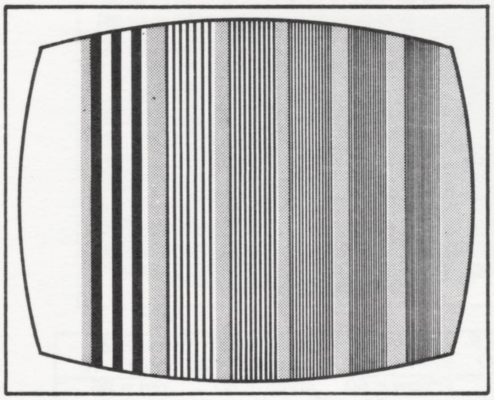
NOTES:

21. When pattern **21** is selected, waveform **U** is generated.
22. When pattern **22** is selected, waveform **V** is generated for top 1/4 of pattern and waveform **U** for bottom 3/4 of pattern. Waveforms **U** and **V** may be superimposed when viewing on oscilloscope.

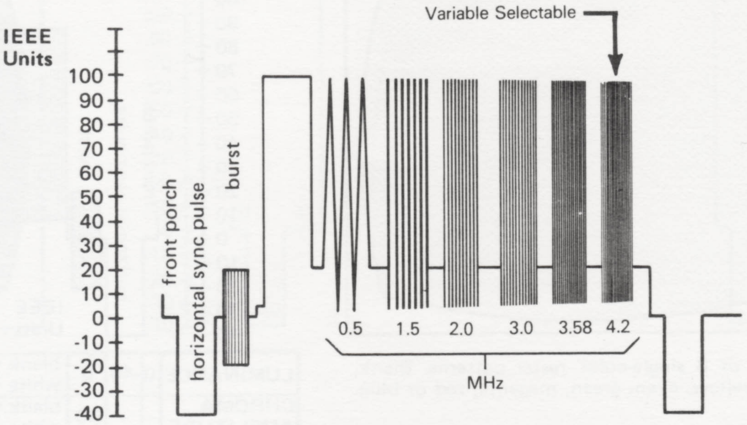
PATTERN

WAVEFORM

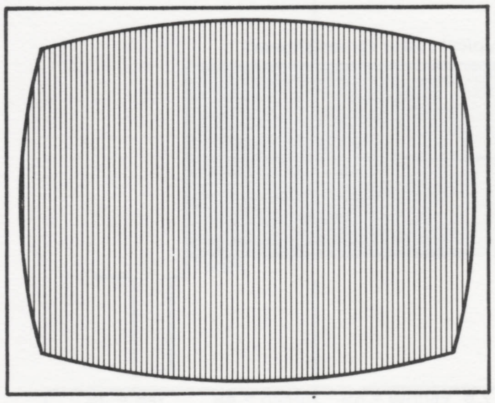
23. GATED MULTIBURST



W. GATED MULTIBURST



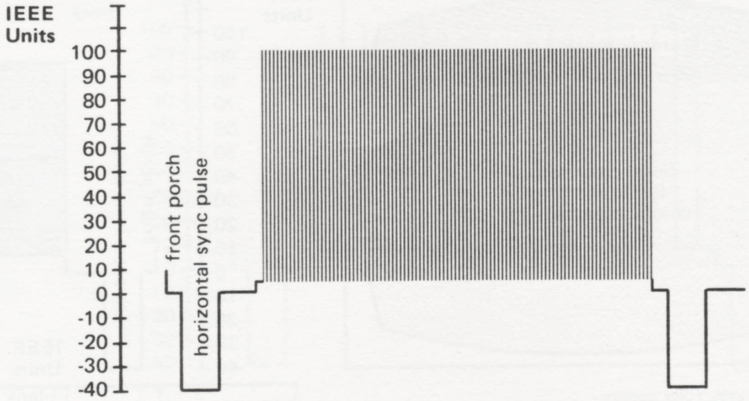
24. FULL FIELD MULTIBURST



2.0 MHz Pattern Shown

Available Frequencies
0.5 MHz
1.5 MHz
2.0 MHz
3.0 MHz
3.58 MHz
4.2 MHz
Variable 2-8 MHz

X. FULL FIELD MULTIBURST

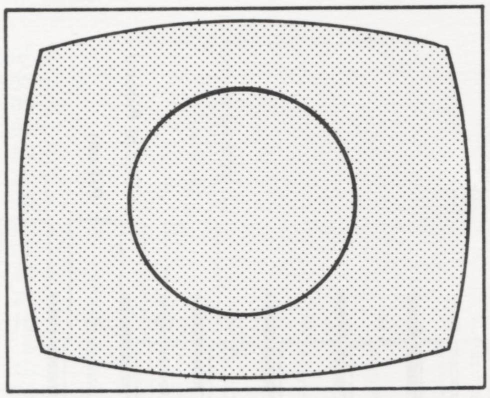


NOTES:

23. When pattern **23** is selected, waveform **W** is generated. A white bar followed by six bursts of sine wave video at 0.5, 1.5, 2.0, 3.0, 3.58, and 4.2 MHz. Variable frequency may be selected to replace 4.2 MHz burst. Color burst can be turned off.
24. When pattern **24** is selected, waveform **X** is generated. Full field of sine wave video at 0.5, 1.5, 2.0, 3.0, 3.58, or 4.2 MHz or variable frequency selectable. No color burst.

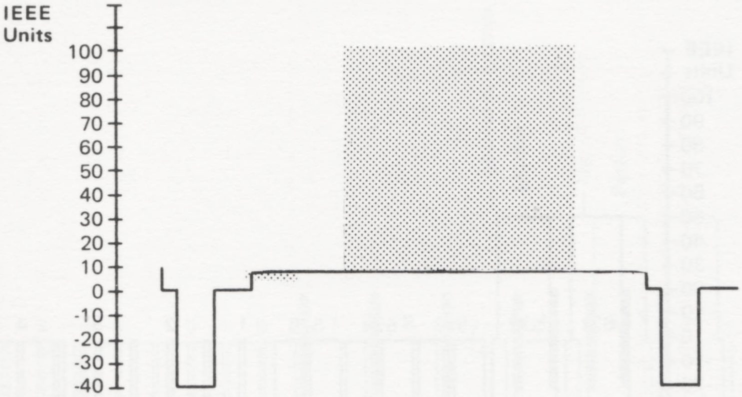
PATTERN

25. CIRCLE



Circle shown superimposed on blank raster. Circle may be superimposed on any pattern.

Y. CIRCLE



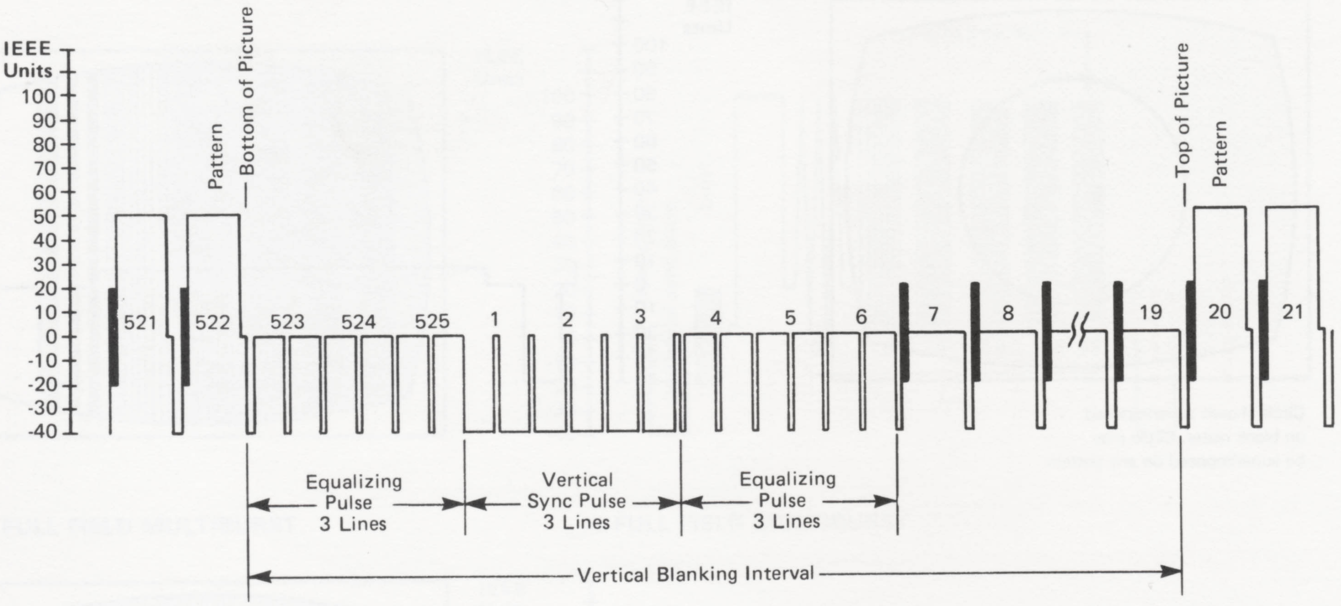
NOTES:

25. When pattern 25 is selected, waveform Y is generated. If pattern 25 is superimposed on another pattern, waveform Y is superimposed on other patterns waveform when viewed on oscilloscope.

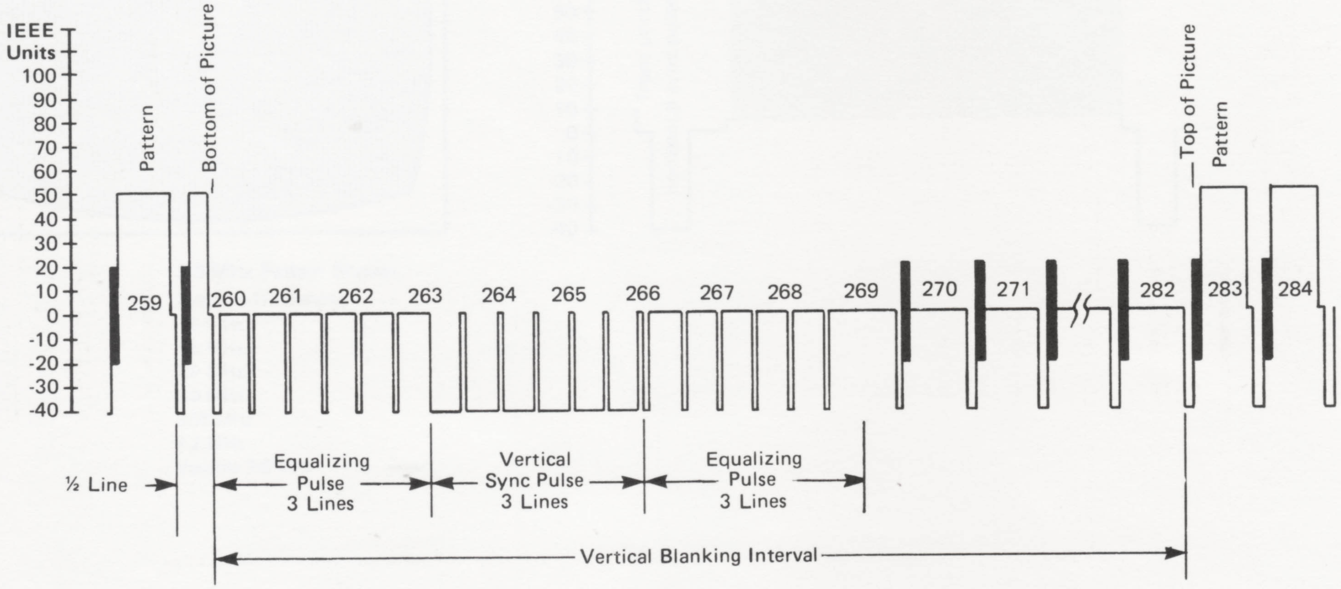
WAVEFORM

25 horizontal lines

Z. VERTICAL INTERVAL, FIELD 1 (INTERLACED SCAN)



AA. VERTICAL INTERVAL, FIELD 2 (INTERLACED SCAN)



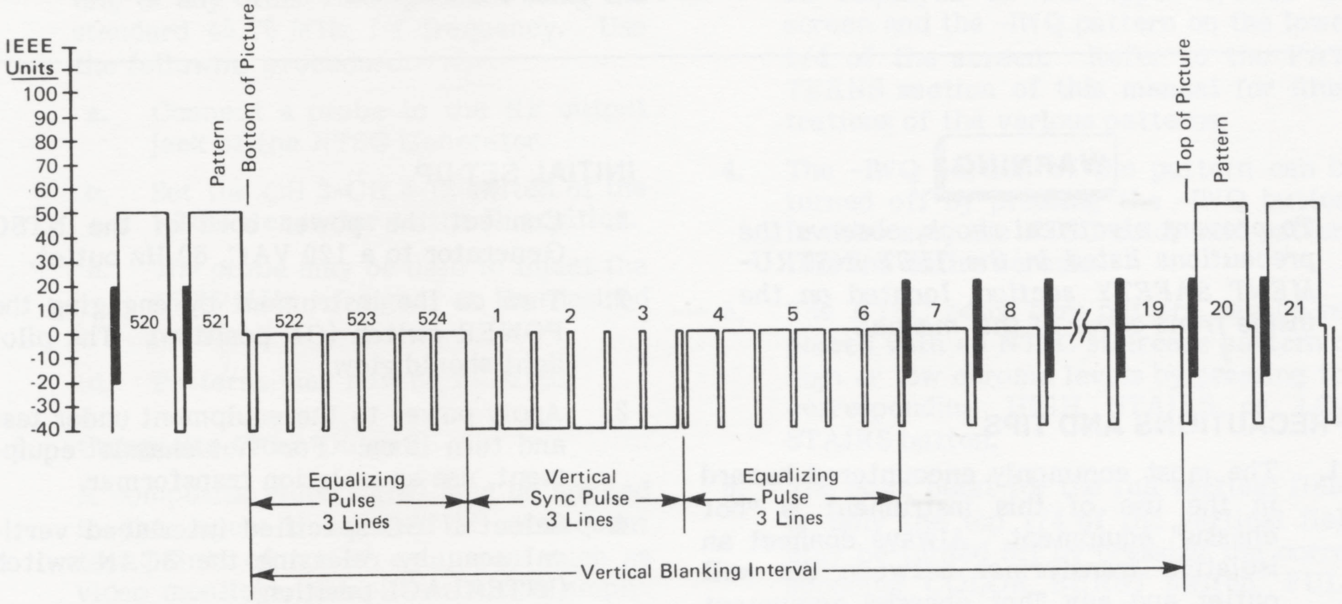
NOTES:

26. Vertical interval waveforms may be superimposed over any pattern waveform when viewing on oscilloscope.

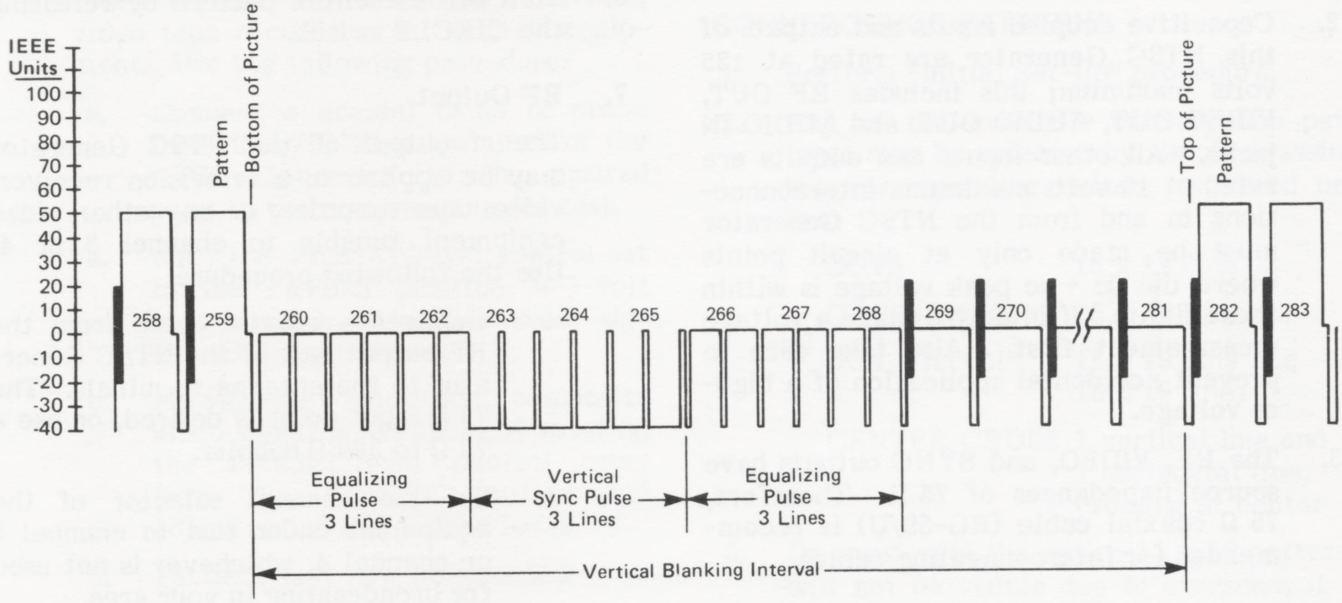
WAVEFORM

25 horizontal lines

BB. VERTICAL INTERVAL, FIELD 1 (NON-INTERLACED SCAN)



CC. VERTICAL INTERVAL, FIELD 2 (NON-INTERLACED SCAN)



NOTES:

27. Vertical interval waveforms may be superimposed over any pattern waveform when viewing on oscilloscope.

OPERATING INSTRUCTIONS

WARNING

To prevent electrical shock, observe the precautions listed in the TEST INSTRUMENT SAFETY section, located on the inside front cover of this manual.

PRECAUTIONS AND TIPS

1. The most commonly encountered hazard in the use of this instrument is "hot chassis" equipment. Always connect an isolation transformer between the wall outlet and any "hot chassis" equipment under test. See the TEST INSTRUMENT SAFETY section, steps 7 and 8, for more information.
2. Capacitive coupled inputs and outputs of this NTSC Generator are rated at ±25 volts maximum; this includes RF OUT, VIDEO OUT, AUDIO OUT, and AUDIO IN jacks. All other inputs and outputs are rated at ±5 volts maximum. Interconnections to and from the NTSC Generator must be made only at circuit points where the dc + ac peak voltage is within these limits. If in doubt, make a voltage measurement first. Also take care to prevent accidental application of a higher voltage.
3. The RF, VIDEO, and SYNC outputs have source impedances of 75 Ω. Therefore, 75 Ω coaxial cable (RG-59/U) is recommended for interconnecting cables.

FAMILIARIZATION

To familiarize yourself with the operating controls, capabilities, and operating characteristics of the NTSC Generator, we recommend that you connect it to a color television receiver that is in good operating condition and observe all the patterns. An oscilloscope or waveform monitor may also be used to observe all the waveforms produced.

INITIAL SET-UP

1. Connect the power cord of the NTSC Generator to a 120 VAC, 60 Hz outlet.
2. Turn on the instrument by engaging the POWER switch (ON position). The pilot light should glow.
3. Apply power to the equipment under test and turn it on. For "hot chassis" equipment, use an isolation transformer.
4. Select NTSC specified interlaced vertical scan by releasing the SCAN switch (INTERLACE position).
5. Select internal sync by pushing the INT switch (one of the GEN LOCK controls).
6. Turn off the circle pattern by releasing the CIRCLE switch.
7. **RF Output.**

   The rf output of the NTSC Generator may be applied to a television receiver, video tape recorder, or any other video equipment tunable to channel 3 or 4. Use the following procedure:

   a. Connect a coaxial cable from the RF output jack of the NTSC Generator to the antenna terminals. The 75 Ω input point is desired, or use a 75 Ω to 300 Ω coupler.

   b. Set the channel selector of the equipment under test to channel 3 or channel 4, whichever is not used for broadcasting in your area.

   c. Set the CH 3-CH 4-IF switch of the NTSC Generator to CH 3 or CH 4, the same channel that was selected on the equipment under test.

   d. Patterns may now be selected.
8. **I-F Output**

   The i-f output of the NTSC Generator may be injected into the i-f section of television receivers, video tape recorders, or any other video product using the standard 45.75 MHz i-f frequency. Use the following procedure:

a. Connect a probe to the RF output jack of the NTSC Generator.

b. Set the CH 3-CH 4-IF switch of the NTSC Generator to the IF position.

c. The probe may be used to inject the 45.75 MHz i-f signal at the desired point.

d. Patterns may now be selected.

9. **Composite Video Output**

A composite video signal may be applied to the input or injected at subsequent test points of non-rf equipment such as video monitors, video distribution amplifiers, signal processing equipment, etc. A composite video signal may also be injected into circuit points after the video detector in television receivers, video tape recorders, or other rf equipment. Use the following procedure:

a. Connect a coaxial cable or probe from the VIDEO output jack of the NTSC Generator to the desired point in the equipment under test.

b. With the PRESET/level control set to the PRESET position, a 1-volt peak-to-peak composite video signal will be generated.

c. A variable amplitude composite video signal is available by rotating the PRESET/level control away from the PRESET position and adjusting for the desired level.

d. Patterns may now be selected.

e. The RF and VIDEO output jacks may be used simultaneously if desired.

NTSC STANDARD PATTERNS

1. Perform "Initial Set-Up" procedure.
2. Press the BARS pushbutton. All other pushbuttons should be out. Release any button that is engaged, including the -IWQ, CHROMA, and COLOR BURST switches.
3. The NTSC color bars pattern should now be displayed on the upper 3/4 of the screen and the -IWQ pattern on the lower 1/4 of the screen. Refer to the PATTERNS section of this manual for illustrations of the various patterns.
4. The -IWQ portion of the pattern can be turned off by pressing the -IWQ button. In this case, the NTSC color bars pattern fills the entire screen.
5. The NTSC color bars pattern can be replaced with an NTSC staircase pattern of high or low chroma levels by pressing the corresponding HIGH STAIRS or LOW STAIRS button.
6. The color burst for the full vertical field, or only the top 1/4 of the vertical field may be turned off by pressing the corresponding COLOR BURST switch, FULL or TOP/MB respectively. Chroma may be turned off entirely (including color burst) by pressing the CHROMA button.

CONVERGENCE PATTERNS

1. Perform "Initial Set-Up" procedure.
2. Any of the available convergence patterns may be selected by simply pressing the corresponding button, as listed below:

DOTS	15 x 19 dots
CROSSHATCH	15 x 19 lines
DOT HATCH	15 x 19 dots and 15 x 19 lines
CENTER CROSS	1 vertical line and 1 horizontal line, crossing at center

3. On most sets the entire 15 x 19 patterns will not be visible due to overscan; it is desirable to display a pattern of at least 13 x 17.
4. The slight vertical jitter observed is the result of using NTSC specified interlaced scan. Jitter free convergence patterns are available by setting the SCAN switch to NON INTERLACE (pushed in).
5. All convergence patterns are monochrome; that is, they consist of luminance only and do not include color burst or chroma.

RASTER PATTERNS

1. Perform "Initial Set-Up" procedure.
2. Press the RASTER switch. This produces a full field raster pattern.
3. Release any RED, GREEN, or BLUE switch that is engaged.
4. Any of eight colors may be selected by the RED, GREEN, and BLUE switches as follows:

RASTER COLOR	PRESS
Blank	none
White	all three
Red	RED only
Green	GREEN only
Blue	BLUE only
Yellow	RED & GREEN
Cyan	BLUE & GREEN
Magenta	RED & BLUE

5. The TOP/MB switch (one of the COLOR BURST controls) is enabled during raster patterns. When pressed, it kills the color burst for the top 1/4 of the pattern.

MULTIBURST PATTERNS

1. Perform "Initial Set-Up" procedure.
2. Press the MULTIBURST switch (one of the PATTERN controls).
3. Release any FULL FIELD switch that is engaged by partially depressing any other FULL FIELD switch.
4. A gated multiburst pattern should be displayed. Refer to the PATTERNS section of this manual for an illustration. This is a monochrome pattern with color burst; unsynchronized color should appear on the 3.58 MHz bar.
5. The color burst may be killed by pressing the TOP/MB switch. This will eliminate the unsynchronized color in the 3.58 MHz bar (6th bar). Although this switch disables the color burst for the top 1/4 of other patterns, it disables the color burst for the full vertical field during multiburst patterns.
6. When the multiburst ADJ/PULL VAR control is pulled, the frequency of the 4.2 MHz bar (7th bar) becomes variable. The frequency may be adjusted by rotation of the ADJ/PULL VAR knob.
7. The gated multiburst pattern is replaced by a full field of one specific multiburst frequency when any of the FULL FIELD buttons is pressed. Any of the following frequencies may be selected by pressing the correspondingly labeled switch.

0.5 MHz	2.0 MHz	3.58 MHz
1.5 MHz	3.0 MHz	4.2 MHz

8. When the ADJ/PULL VAR knob is pulled, the frequency of the 4.2 MHz full field selection becomes variable. The frequency may be adjusted by rotation of the ADJ/PULL VAR knob.
9. Any multiburst frequency may be measured by connecting a cable from the MULTIBURST OUT jack on the rear panel of the NTSC Generator to a frequency counter. The MULTIBURST switch must be OFF during the measurement. This allows the multiburst generator to run continuously, without blanking (blanking would interrupt the frequency counter input and invalidate the frequency reading). Press the corresponding FULL FIELD button to select the desired multiburst frequency. The frequency is adjustable from about 2 MHz to 7 MHz by rotation of the ADJ/PULL VAR control when the 4.2/VAR switch is engaged and the ADJ/PULL VAR knob is pulled.

CIRCLE PATTERN

Circle pattern selection is independent of other pattern controls and the circle may be superimposed on any pattern.

1. Perform "Initial Set-Up" procedure.
2. Select the desired background pattern onto which the circle is to be superimposed. If no background pattern is desired, select a blank RASTER pattern.
3. To display the circle, press the CIRCLE switch.
4. The circle size fills about 73% of the vertical field. This makes it possible to see the entire circle, even on monitors

and TV screens with a high degree of overscan. When the circle is superimposed on the crosshatch pattern, it spans 11 vertical divisions and 11 horizontal divisions of the crosshatch pattern.

SOUND

1. To use internal sound modulation:
    a. Sound may be added to the rf or i-f output by setting the INT MOD-AUDIO OUT-EXT MOD switch to the INT MOD position.
    b. A 1 kHz or 3 kHz tone may be selected by setting the 1 kHz-3 kHz-OFF switch to the 1 kHz or 3 kHz position respectively. A 3 kHz tone is preferred for most video tape recorder tests.
2. To use external sound modulation:
    a. Connect an audio generator or other source of audio signal to the AUDIO IN jack on the front panel of the NTSC Generator.
    b. Set the audio level to 1 to 3 volts peak-to-peak.
    c. Set the INT MOD-AUDIO OUT-EXT MOD switch to the EXT MOD position. The rf or i-f output of the NTSC Generator will now be modulated by the external audio input signal.
    d. The audio bandwidth of the external audio input circuit is 100 Hz to 10 kHz. The pre-emphasis characteristic of the NTSC Generator and the de-emphasis characteristic of any video rf receiver should combine for approximate constant amplitude over this bandwidth. An audio sweep generator such as the **B & K-Precision** Model 3020, 3025, or 3030 Sweep/Function Generator is a convenient way to check frequency response.
3. If no sound modulation is desired, set the INT MOD-AUDIO OUT-EXT MOD switch to AUDIO OUT. The RF output will not be modulated by sound.
4. To use the external audio output:
    a. Connect a cable from the AUDIO OUT jack on the rear of the NTSC Generator to the audio equipment or circuit under test.
    b. Set the INT MOD-AUDIO OUT-EXT MOD switch to INT MOD or AUDIO OUT. Audio output is available simultaneously with INT MOD if desired. However, audio output is not available simultaneously with EXT MOD.
    c. Select a 1 kHz tone by setting the 1 kHz-3 kHz-OFF switch to 1 KHz or a 3 KHz tone by setting the switch to 3 kHz. An audio signal at the selected frequency will be present at the AUDIO OUT jack (3 volts peak-to-peak into 1 kΩ).
5. Set the 1 kHz-3 kHz-OFF switch to OFF when neither internal modulation nor external audio output is desired.

EXTERNAL VIDEO OUTPUT

If an external source of composite video signal is available, such as a video camera, it may be used to modulate the rf output of the NTSC Generator.

1. Connect the external composite video signal to the EXT. VIDEO IN jack on the rear panel of the NTSC Generator.
2. Set the INT-EXT VIDEO switch to the EXT position.
3. The RF output of the NTSC Generator is now modulated by the external video input.
4. Internally generated composite video is still available at the VIDEO output jack.
5. The internal and external video can be synchronized if desired by using GEN LOCK operation as described in the next paragraph.

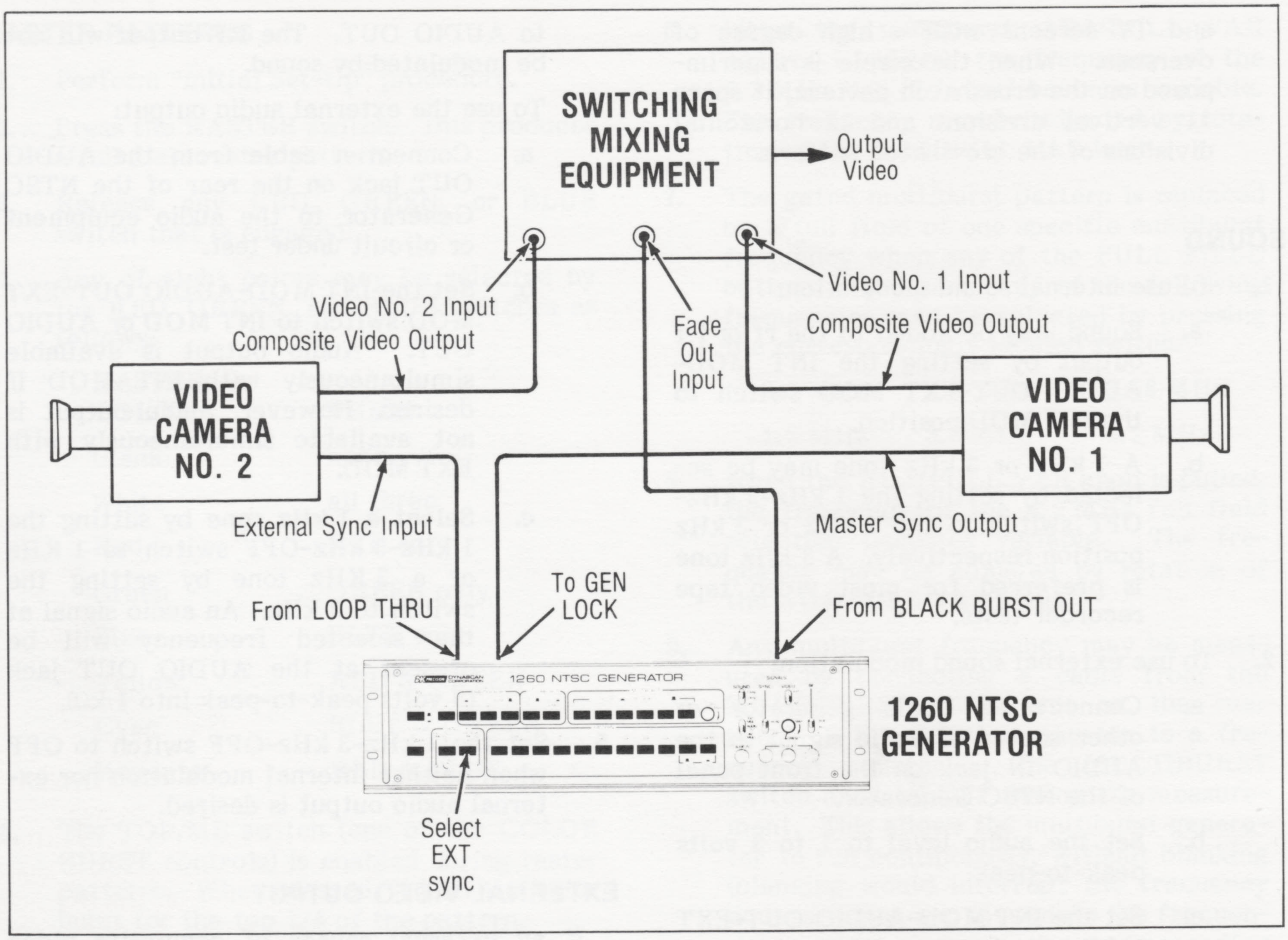


Fig. 19. Typical "Gen Lock" Configuration.

GEN LOCK
(refer to Fig. 19, 20, and 21)

This NTSC Generator may be "Gen Locked" to an external video signal if desired. This is usually a studio application such as shown in Fig. 19. All video cameras and video signal sources must be in sync with each other to prevent tearing of the picture when mixing video signals or when switching from one camera to another. In such an application, the NTSC Generator is often the source of a "black burst" signal that is mixed with the signal from a video camera to create "fade out" or "fade in" scenes. One of the cameras would typically be used as the "master" video signal and all other equipment would be externally synchronized to this "master" signal. Of course, any composite video signal source could be the "master" signal, including the output of this NTSC Generator. Actually, only the composite sync and color burst are used for external sync, thus the "black burst" output of the Model 1260 could serve this function.

During "Gen Lock" operation, the sync generator of the Model 1260 NTSC Generator is "locked" to an external composite video signal. Horizontal sync delay and chroma phase are adjustable to coincide with the "Master" signal.

Set up the equipment for "Gen Lock" operation as follows:

1. Connect the "Master" video signal to the GEN LOCK jack on the rear panel of the NTSC Generator.
    a. The "Master" video signal must be a standard 1-volt peak-to-peak composite video signal into 75 Ω.

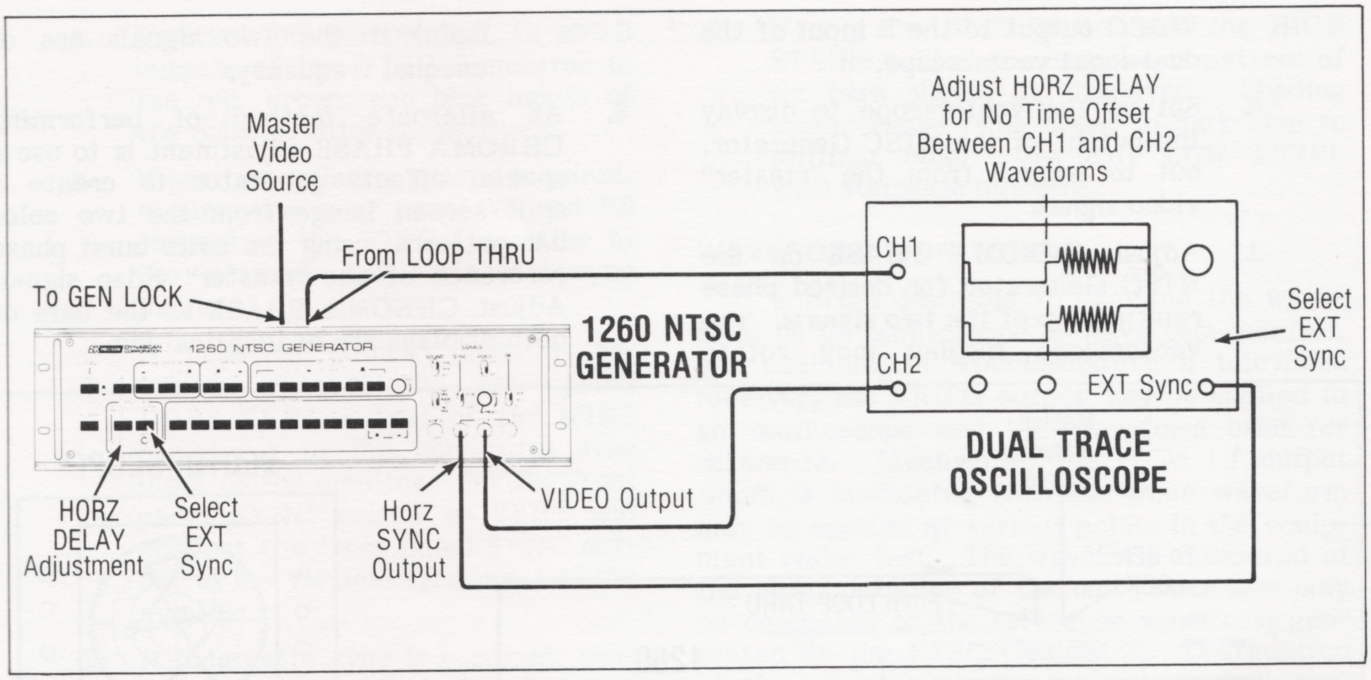


Fig. 20. Adjusting HORZ DELAY.

b. When a Model 1260 NTSC Generator is used as the source of "Master" video, use the VIDEO output or BLACK BURST output for this purpose.

c. If additional units are to be "Gen Locked" to the "Master" video signal, connect a 75 Ω coaxial cable from the LOOP THRU jack on the rear panel to the next unit.

d. Terminate the final "Gen Locked" unit into 75 Ω.

2. Set the GEN LOCK switch to EXT. The NTSC Generator now becomes "locked" to the "Master" video signal.

3. The EXT SYNC PRESENT and EXT BURST PRESENT indicators should light, indicating that the signal level is adequate.

4. Adjust HORZ DELAY as follows: (Refer to Fig. 20)

a. Connect the "Master" video signal and the VIDEO output of the NTSC Generator to the CH 1 and CH 2 inputs of a dual trace oscilloscope - "Master" to CH 1.

b. Connect the output of the SYNC jack of the NTSC Generator to the external sync input of the oscilloscope and set the SYNC switch to HORZ. Set the oscilloscope for external triggering. If the oscilloscope is equipped with a video sync separator, simply set up the oscilloscope for dual trace display using the CH 1 signal for internal sync and select the "Video Line" (Horz) mode of trigger coupling.

c. Expand the waveforms for a good view of the horizontal sync pulse. Superimpose the two waveforms if desired for more readily determining if there is any time difference between the two.

d. Adjust HORZ DELAY on the NTSC Generator to eliminate any time difference.

5. Adjust CHROMA PHASE as follows: (Refer to Fig. 21)

a. Connect the "master" video signal to the A input of a dual-input vectorscope. The "master" video signal must be an NTSC color bars pattern for this adjustment.

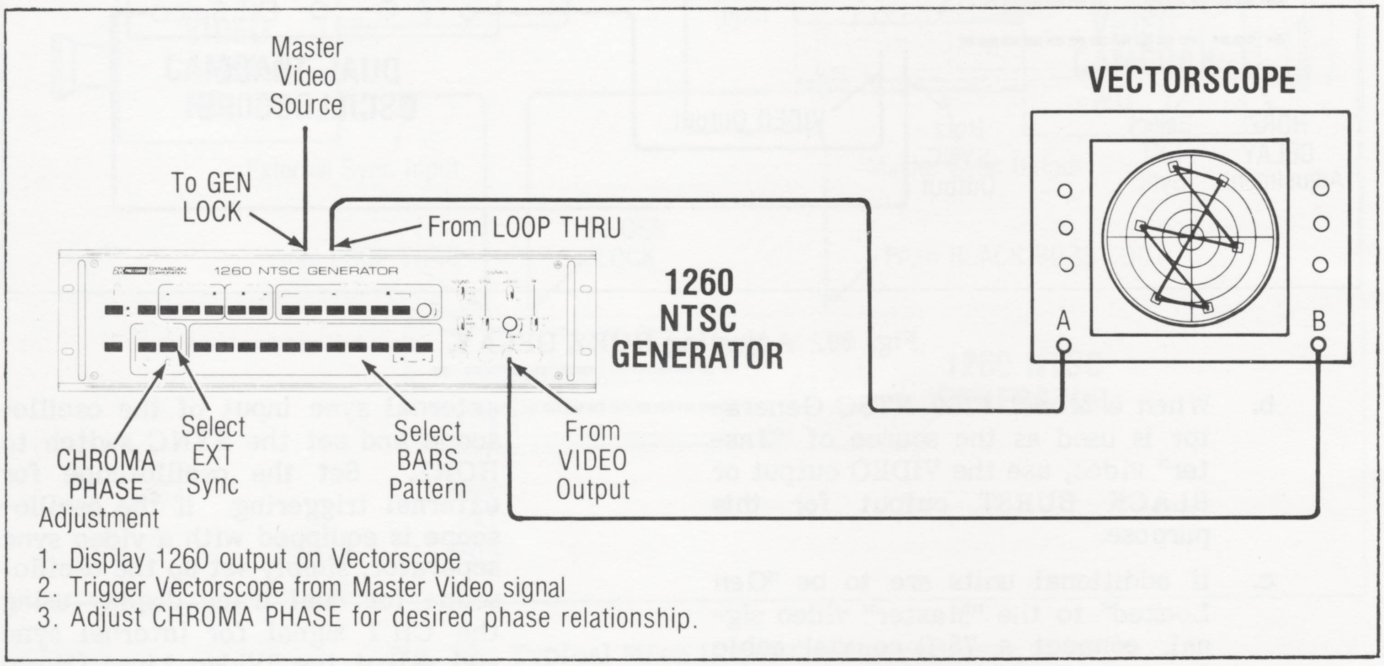
b. Select the BARS pattern on the NTSC Generator and connect the

VIDEO output to the B input of the dual-input vectorscope.

c. Set up the vectorscope to display the output of the NTSC Generator, but to trigger from the "master" video signal.

d. Adjust CHROMA PHASE on the NTSC Generator for desired phase relationship of the two signals. The vectorscope display may rotate (spin) if the two signals are of unequal frequency.

6. An alternate method of performing CHROMA PHASE adjustment is to use a special effects generator to create a split screen image from the two color bar patterns, using the color burst phase reference of the "master" video signal. Adjust CHROMA PHASE so the bars of both displays are of identical hue.



1. Display 1260 output on Vectorscope
2. Trigger Vectorscope from Master Video signal
3. Adjust CHROMA PHASE for desired phase relationship.

Fig. 21. Adjusting CHROMA PHASE.

RGB OUTPUT

Independent red, green, and blue (RGB) outputs are available for testing color monitors that use separate red, green, and blue inputs rather than a composite video input. Such color monitors are often used with computers having color graphic display capability, etc.

Some color monitors accept either composite video signals or RGB signals. Often, positive polarity vertical and horizontal sync is also required in RGB monitors. Some RGB monitors use low level RGB signals and vary color saturation in response to analog changes of signal level. Others use higher TTL level excitation and display only fully saturated colors. The Model 1260 NTSC Generator provides outputs for all versions.

Separate R, G, and B outputs with selectable LOW or HIGH level are available at BNC connectors on the rear panel. In addition, positive polarity VS (vertical sync) and HS (horizontal sync) are available at additional BNC connectors on the rear panel. To simplify connections, a 9-pin receptacle is provided which mates with the 9-pin connector used on the most common RGB monitor configuration. This duplicates the functions of the R, G, B, VS, and HS jacks in one connector so that all connections are made simultaneously with a single cable. Negative polarity COMP SYNC, HOR SYNC, and selectable (front panel) vertical or horizontal SYNC is also available if needed.

The procedure for using the RGB outputs is as follows:

1. Connect the RGB outputs of the NTSC Generator to the inputs of the color monitor.

   a. Connect the rear panel R, G, and B outputs of the NTSC Generator to the red, green, and blue inputs of the color monitor respectively.

   b. If positive polarity sync is required, connect the rear panel VS and HS outputs of the NTSC Generator to the vertical and horizontal sync inputs of the monitor.

   c. If negative polarity sync is required, connect the rear panel HORZ SYNC output of the NTSC Generator to the horizontal sync input of the monitor. Set the front panel SYNC switch to VERT and connect the front panel SYNC output to the vertical sync input of the monitor.

   d. If composite sync is required, connect the rear panel COMP SYNC output of the NTSC Generator to the sync input of the monitor.

   e. If the color monitor is equipped with a 9-pin connector that mates with the RGB receptacle on the rear of the NTSC Generator, connect it. All necessary connections will be made simultaneously.

2. Select LOW LEVEL or HIGH LEVEL as appropriate for the monitor being tested.
3. Select the desired pattern with the PATTERN switch. The RASTER, DOTS, CROSS HATCH, DOT HATCH, CENTER CROSS, MULTIBURST, LOW STAIRS, HIGH STAIRS or CIRCLE patterns may be selected. (The BARS pattern is not intended for use with RGB monitors. However, if the BARS pattern is selected, and the -IWQ portion is on, a box appears in the lower 1/4 of the pattern; same location as white area of -IWQ signal.)
4. Select the color of the pattern with the RASTER/RGB controls; the same eight colors are available as for raster patterns. Use the RED, GREEN, and BLUE switches singly or in combination.
5. For example, if the RED and GREEN buttons and the CROSS HATCH button are engaged, a crosshatch pattern will be displayed in fully saturated yellow.
6. If only the BLUE button and the HIGH STAIRS button are engaged, a pattern of six bars should be displayed. Shading should range from black to dark blue to brilliant blue. Use only LOW LEVEL with staircase patterns.

WAVEFORM MONITORING

It is often desirable to examine the waveform on an oscilloscope or waveform monitor. For example, in troubleshooting a television receiver, the VIDEO output may be applied to an oscilloscope and the waveform used for reference. Meanwhile, the rf or i-f output which is modulated with the same waveform may be applied at various points in the equipment under test. The waveform measured at the video detector of the unit under test may be compared to the reference waveform generated by the NTSC Generator. Degradation of the waveform indicates poor circuit performance or misadjustment. A dual trace oscilloscope is very handy for such waveform comparison.

1. Connect a coaxial cable from the VIDEO output jack to the vertical input of the oscilloscope. Terminate into 75 ohms.
2. Connect another cable from the SYNC output jack to the external trigger input of the oscilloscope.
3. Select the external triggering mode on the oscilloscope.
4. Set the front panel SYNC switch to the HORZ position for observing lines of composite video signal or to the VERT position for observing vertical fields or frames.
5. A sweep rate of about 10 µs/div is appropriate for viewing horizontal lines of composite video, 2 ms/div for viewing vertical fields, and 5 ms/div for viewing vertical frames. The sweep vernier may be used for fine adjustment of the waveform display.

SUBCARRIER OUTPUT

The frequency of the 3.579545 MHz color subcarrier may be checked by connecting a frequency counter to the SUBCARRIER OUT jack of the NTSC Generator, except during FULL FIELD multiburst patterns (because the subcarrier generator circuit is disabled).

MULTIBURST OUTPUT

The multiburst frequency may be measured by connecting a frequency counter to the MULTIBURST OUT jack of the NTSC Generator. This may be used to check the accuracy or make recalibration adjustments of the multiburst frequencies, or for setting the variable multiburst to a specific frequency. The MULTIBURST OUT signal should be measured only with the MULTIBURST switch OFF. If measurement is attempted with the MULTIBURST switch ON, the output signal is interrupted during horizontal and vertical blanking pulses. This causes the frequency counter to read substantially below the actual frequency, or makes it impossible to obtain a stable reading.

SIMULTANEOUS OUTPUTS

For maximum flexibility, all output jacks may be used simultaneously if desired. This can be a valuable aid in many applications. These outputs are summarized as follows:

The VIDEO output is continuously available when the instrument is operating. The video component of the signal is dependent upon the selected pattern.

The RF output is also continuously available when the instrument is operting. It may be set to operate on channel 3, channel 4, or i-f frequencies. Normally, it is modulated by the same signal that appears at the VIDEO output jack, but modulation by an external video input may be selected. The signal at the VIDEO output jack does not change when external video is selected.

The RF output may also be modulated by a sound intercarrier with a choice of 1 kHz or 3 kHz internal audio or external audio. The sound intercarrier may be turned off if desired.

The AUDIO OUT signal is available at all times except during external sound modulation; i.e., when the EXT MOD-AUDIO OUT-INT MOD switch is set to AUDIO OUT or INT MOD. A frequency of 1 KHz or 3 KHz may be selected by the 1 kHz-3 kHz-OFF switch.

The front panel SYNC output is continuously available when the instrument is operating, with a choice of horizontal or vertical sync pulses, as selected by the accompanying HORZ-VERT switch. Horizontal sync is available continuously at the rear panel HORZ SYNC jack, composite sync is available continuously at the COMP SYNC jack, and composite blanking is available continuously at the COMP BLANK jack. Positive polarity horizontal and vertical sync is available continuously at the HS and VS jacks respectively.

The SUBCARRIER output is continuously available when the instrument is operating, except that the subcarrier generator is disabled during FULL FIELD multiburst patterns.

The MULTIBURST OUT signal is available whenever the instrument is operating. As explained previously, when the MULTIBURST pattern is selected, the output signal is interrupted by composite blanking When the MULTIBURST pattern switch is OFF, the output signal is continuous. The frequency is selected by the FULL FIELD switches.

APPLICATIONS

NTSC COLOR BARS

Versatility

The NTSC color bars pattern is the basic pattern used for most testing, troubleshooting, and adjustments in video equipment. It is one of the most valuable and versatile color patterns ever devised. This precision color bar pattern is used as the reference for set-up and compensation adjustments in television studio and transmitting equipment. The NTSC color bars pattern is very effective for adjusting any type of consumer or industrial color video equipment for maximum performance. For troubleshooting and servicing, analysis of the NTSC color bars pattern or its waveform usually localize a color related problem to a few specific circuits.

Color Television Receivers

The NTSC color bars pattern provides a standard reference for color adjustments and troubleshooting in television receivers. The pattern contains bars of the three primary colors: red, blue, and green. These are a good reference for checking 3.58 MHz phase problems. The white, yellow, cyan, and magenta help define problems wherein the mix of colors is not in the correct proportions. The CHROMA OFF switch removes the chroma component entirely and is very helpful in defining problems as either chroma or luminance related.

With the NTSC color bars pattern applied, phase lock of the 3.58 MHz oscillator can be checked by use of the TOP/MB COLOR BURST switch. Color will be unsynchronized for the top 1/4 of the pattern, but there should be no delay or color distortion where the color bars start (the entire color pattern may remain synchronized on some sets, depending upon design).

The FULL COLOR BURST switch checks the color killer circuit. If the color killer is working properly, the pattern should change from color to monochrome. If the pattern instead changes to unsynchronized color, the color killer is defective.

Video Recorders

The NTSC color bars pattern (BARS button) is virtually a necessity for video recorder servicing. This includes studio type video tape recorders, video cassette recorders (VCRs), and video disc players. Most manufacturers specify an NTSC color bar input signal in their literature. Adjustment procedures are usually based upon an NTSC color bar input, and the waveforms shown at various points on the schematic diagram are those obtained with an NTSC color bar input. Some manufacturers provide "field" and "factory" procedures in their literature. However, the "field" procedures merely eliminate all adjustments that require an NTSC color bars pattern, which severely restricts the amount of servicing that can be performed. With an NTSC generator, you can perform the "factory" procedures. An NTSC color bars pattern is essential for chroma and luminance alignment. An NTSC color bars pattern is also preferred for general troubleshooting.

Overall VCR Performance

An overall performance test of a VCR may be conducted by recording the NTSC color bars pattern, then playing it back on a video monitor. There should be no noticeable difference between the video played back from the VCR and an NTSC color bars pattern applied directly to the monitor.

Luminance and Chroma Balance

In a VCR, the luminance and chroma signals are separated during the recording process, and re-combined during the playback process. If luminance and chroma signals are not maintained at the proper proportions when separated, color distortion will probably result, particularly in the vividness of colors or color saturation. Waveforms may be examined throughout the VCR for proper luminance to chroma proportions. Another problem that may be encountered is a difference in delay between the luminance signal and the chroma signal. This will cause fuzziness along the edges of the color bars. This problem may be more pronounced along the edges of the white bar in the -IWQ portion of the pattern.

-IWQ

The -IWQ pattern appears on a split field with the NTSC color bars pattern, with the -IWQ pattern appearing on the lower 1/4 of each field. When viewing horizontal lines of video on an oscilloscope, both signals are superimposed, which is very handy in many applications. The 7.5% black level and 100% white level of the -IWQ pattern are key luminance amplitude references. These black and white level references are used for FM deviation adjustment and black and white clip level adjustments in VCRs. They are also used when luminance and chroma ratios are being adjusted, or being checked during troubleshooting. The -I and Q signals are used primarily in video cameras and studio equipment for setting up the phase and amplitude of the -I and Q signals, and maintaining the proper relationship between the two.

STAIRCASE

Non-Linear Distortion

The staircase patterns contain five equal steps of increasing luminance with a constant chroma amplitude and phase. With CHROMA off, only the luminance steps are generated. This pattern is valuable for checking amplifier linearity. The amplitude of each step should be equal in the output of a circuit, since they were equal in the input signal. Non-equal steps represent non-linear distortion.

White Clip Adjustment

The staircase patterns are desirable for setting the white clip level in VCRs. Since the top step is 100% white level, it provides the correct reference for white clip level adjustment. If white clip is set too low, the top step will have less amplitude than other steps.

Frequency Equalization

The staircase patterns are recommended for frequency equalization adjustment in the record amplifier circuit of VCRs. The FM signal which carries luminance information in a VCR is shifted to a different frequency with each step of the staircase signal. However, record current should remain constant across the FM frequency band. Frequency equalization should be adjusted so that record current is equal for all steps of the staircase input signal.

Differential Gain and Differential Phase

Among other uses of the staircase patterns are checking differential gain and differential phase, both causes of color distortion. Differential gain and differential phase are checked often in studio signal processing equipment, and can be the cause of problems in VCRs, color receivers, video monitors, etc.

Chroma amplitude should not change as luminance is varied from 0 to 100%. Any interaction is called differential gain. To check for differential gain, the output of the chroma circuit is displayed on a precision waveform monitor while the staircase pattern input is applied. As the luminance signals steps from 0 to 100% in 20% increments, any differential gain will cause changes in the chroma amplitude in synchronization with the luminance steps. Sometimes, the degree of differential gain may be affected by the peak-to-peak amplitude of the chroma signal. This characteristic can be checked by switching between the LOW STAIRS and HIGH STAIRS patterns. The LOW STAIRS pattern generates 20 IEEE units chroma amplitude while the HIGH STAIRS pattern generates 40 IEEE units.

Chroma phase should not shift as luminance is varied from 0 to 100%. Any interaction is called differential phase. To check differential phase, the output of the chroma circuit is displayed on an NTSC vectorscope while the staircase pattern input is applied. As the luminance signal steps from 0 to 100% in 20% increments, any differential phase will cause changes in the vector angle in sychronization with the luminance steps. Switching between the LOW STAIRS and HIGH STAIRS patterns will reveal whether or not the degree of differential phase is affected by chroma amplitude.

CONVERGENCE

Center Cross Pattern

The CENTER CROSS pattern should intersect at the center of the screen and there should be no tilt of the horizontal line. Improper centering indicates the need for centering adjustment or a deflection circuit fault. Tilt may require repositioning of the deflection yoke for correction. This pattern also provides a good general check of vertical and horizontal sync.

Dots Pattern

The DOTS pattern is used for static convergence, usually by converging the center dot of the pattern. A 19 x 15 dot pattern is generated. Most sets have some overscan so that all dots are not visible, except possibly under low voltage conditions. Some sets have a tendency toward more overscan than others. It is desirable to display at least a 17 x 13 dot pattern.

Crosshatch Pattern

The CROSSHATCH pattern is normally preferred for dynamic convergence, although some technicians prefer the DOTS pattern for both static and dynamic convergence. The CROSSHATCH pattern is also used to check pincushion distortion, which often appears at the outside edges of large screen TV sets as bends in the lines.

Dot Hatch Pattern

The DOT HATCH pattern combines the DOTS and CROSSHATCH patterns for a quick overall check of static and dynamic convergence, linearity, overscan, and pincushion distortion from a single pattern.

CIRCLE

The CIRCLE pattern is the most accurate method of checking linearity of a television set or monitor. A visual check will quickly reveal any non-linearity, because the circle will not be perfectly round. The CIRCLE pattern may be superimposed over any other pattern when desired.

Size and linearity adjustments often interact, and are adjusted in conjunction with each other to achieve the best combination. The CIRCLE superimposed over the CROSSHATCH is one of the most convenient patterns available for making size and linearity adjustments. The CROSSHATCH lines can be used for size adjustment and the superimposed CIRCLE can be used for linearity adjustment, while any interaction is immediately visible. If a width adjustment is included, it should be set first, then vertical size and linearity should be set to obtain a round circle. The entire 15 x 19 lines of the CROSSHATCH pattern are usually not all visible because of overscan, but 13 x 17 lines are desirable at normal line voltage. The circle height and width are equal to 11 lines of the CROSSHATCH pattern, so that the entire circle is still visible in cases of severe overscan.

RASTER

The RASTER patterns are valuable for checking and adjusting purity. Not only can the white raster be used in the standard manner, but the three separate guns may be individually adjusted using a continuous chroma signal of RED, BLUE, or GREEN.

While the NTSC color bars pattern continuously displays all eight colors, the RASTER patterns permit a full field display of any one of those eight colors, which may simplify analysis of hue and saturation problems. Such analysis may require selection of the individual primary colors of RED, BLUE, and GREEN, or the YELLOW, CYAN, and MAGENTA hues which are the equal mixture of two primary colors without the third primary color. The luminance and chroma components for each raster color are identical to the corresponding bar from the color bars pattern.

A blank raster is generated when none of the three primary colors are selected.

A raster pattern may be used for setting record current in a VCR.

MULTIBURST

Multiburst patterns are used to measure horizontal resolution, video bandwidth, and i-f bandwidth.

Gated Multiburst

The gated multiburst pattern provides a burst of white (dc) followed by bursts of sine wave video at 0.5 MHz, 1.5 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz, and 4.2 MHz. Each burst of the gated multiburst pattern is generated at equal amplitude. Checking the waveform at various points in the equipment under test shows how much each of the frequencies has been attenuated.

Full Field Multiburst

Full field multiburst patterns provide a full screen of one specific multiburst frequency. This allows more complete analysis of a circuit at a specific video frequency. It may also be used to check horizontal linearity, as the spacing between lines should be be the same at the left, right, and center of the screen.

Variable Frequency Multiburst

The 4.2 MHz burst of the gated multiburst pattern or the 4.2 MHz full field multiburst pattern may be replaced by a variable frequency multiburst by pulling the PULL VAR knob on the front panel. The frequency is then adjustable by the VAR ADJ knob. The range of adjustment spans at least 2 to 8 MHz. The variable frequency multiburst allows a check of resolution and bandwidth between the available steps.

Horizontal Resolution

Horizontal resolution defines the smallest horizontal increment that can be discerned on the CRT screen. This is tested by applying the gated multiburst pattern, a sine wave video signal of progressively higher frequencies. This produces a pattern of alternate black and white lines. As the video frequency increases the lines of the pattern become closer together.

Resolution is expressed as a frequency. The maximum frequency at which individual lines can be discerned is the horizontal resolution of the equipment under test. Above this frequency, the lines run together and appear as solid gray. For example, if the individual lines of the 3.0 MHz bar are visible, but the lines of the 3.58 MHz bar appear as solid gray, the resolution is 3 MHz. If a more precise measurement is desired, the variable frequency multiburst pattern may be selected and adjusted to the highest frequency that individual lines can be distinguished. For the case cited above, this frequency should be somewhere between 3.0 and 3.58 MHz. That frequency can then be measured at the MULTIBURST OUT jack.

Video Bandwidth

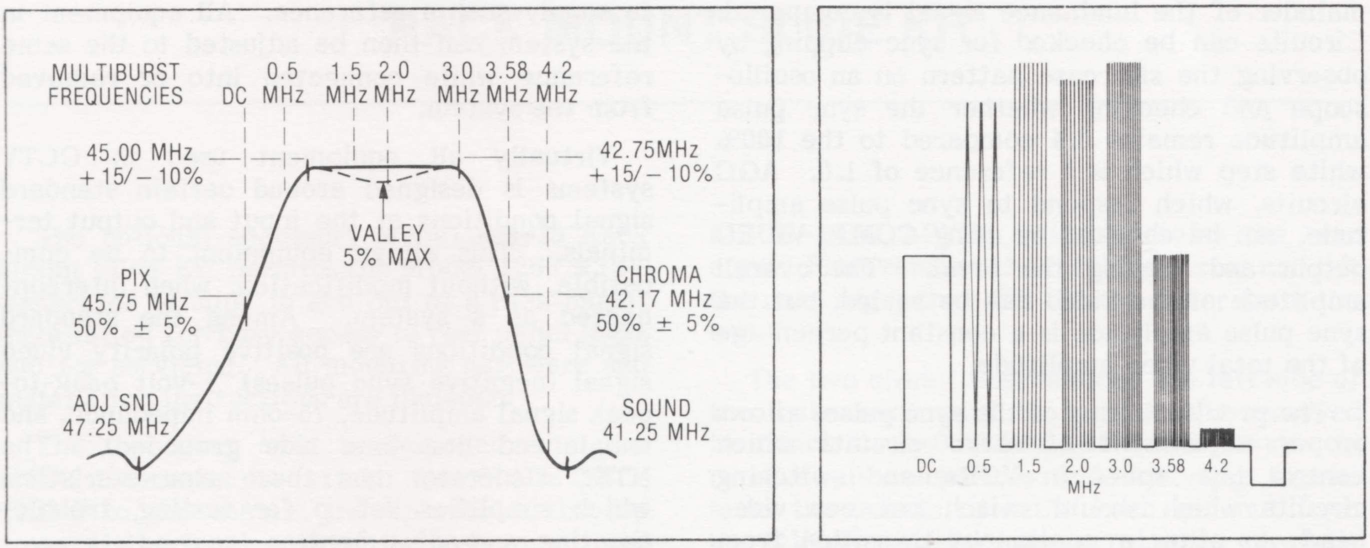
In most equipment, horizontal resolution is limited by the video bandwidth. The video amplifier bandwidth is normally less than 4.5 MHz to block the sound intercarrier from the video. In a color television receiver, video bandwidth should be greater than 3.58 MHz in circuits carrying luminance and chroma signals, and less than 3.58 MHz in circuits carrying luminance signals only. By applying the gated multiburst signal and observing the waveform at various points in the video circuits, bandwidth can be measured.

In an example, let us say the dc, 0.5 MHz, 1.5 MHz, and 2.0 MHz bursts are all about the same amplitude in the observed waveform. The amplitude of the 3.0 MHz burst is about 70% of 2.0 MHz burst. The 3.58 MHz and 4.2 MHz bursts are at much lower amplitude. Since all frequencies are generated at the same amplitude, this indicates a video bandwidth of dc to 3.0 MHz. There is a flat frequency response from dc to 2.0 MHz and a -3 dB point of about 3.0 MHz. The effectiveness of the 3.58 MHz traps is also displayed by the amplitude of the 3.58 MHz burst.

If the RF output signal of the NTSC Generator is used and applied to the antenna terminals, the observed waveforms will include the effects of the i-f bandwidth as well as the video bandwidth. To eliminate the possible effects of the i-f bandwidth in video bandwidth measurements, use the VIDEO output of the NTSC Generator and apply the signal at the video detector.

I-F Bandwidth

The gated multiburst pattern is valuable for measuring the i-f bandwidth and aligning the stagger-tuned i-f stages. Apply the RF output of the NTSC Generator to the antenna terminals and measure the waveform at the video detector. Modulate the rf output with the gated multiburst pattern. The observed waveform can be interpreted as an i-f bandwidth measurement (see Fig. 22).



A. Typical I-F Response Curve.

B. Corresponding Multiburst Waveform at Video Detector.

Fig. 22. Using the Gated Multiburst Pattern for I-F Bandwidth Measurement.

Fig. 22A is the desired frequency response of the i-f section. The typical i-f bandwidth has half voltage at the video carrier frequency of 45.75 MHz. The lower sideband is attenuated to suppress the adjacent channel. The bandwidth for the upper sideband is shaped for a flat frequency response for video of 0.5 MHz to 3.0 MHz. The sideband resulting from the 3.58 MHz color subcarrier is at half voltage. The 4.5 MHz sound intercarrier is suppressed, as is response to the higher adjacent channel.

Since the gated multiburst pattern produces sidebands at all significant frequencies of the i-f bandwidth, the waveform of Fig. 22B may be used to measure or align i-f bandwidth. This method does not require a separate sweep generator and frequency markers.

Stagger tuning is normally used to widen the i-f bandwidth for a flat response from 0.5 MHz to 3.0 MHz. The gated multiburst signal may be used to realign a stagger-tuned i-f section.

The 4.2 MHz or variable multiburst set to operate at 4.5 MHz is very effective for checking and adjusting 4.5 MHz sound traps.

High Resolution Video Monitors

High resoltion video monitors, such as computer terminals for displaying text, may have horizontal resolution much greater than 4 MHz. Since such equipment is not intended for reception of commercially transmitted television signals, it does not normally include a tuner and i-f section. There are no adjacent channels or 4.5 MHz sound intercarrier to suppress, and video amplifiers may have bandwidths of dc to 8 MHz or more. The variable frequency is adjustable to 8 MHz ±1 MHz.

RF AND I-F

The tuners and i-f sections of VCRs and color television receivers are essentially the same. Servicing of these sections can be aided by the rf and i-f outputs of the NTSC Generator. Performance of the VCR or TV set should be nearly as good when using the rf signal on channel 3 or 4 as when applying composite video directly into the video section. If not, there is a problem in the tuner or i-f section, which can be isolated by injecting rf or i-f signals at various points and identifying the point at which normal operation is lost.

SYNC

Every pattern includes NTSC sync pulses, the same as those produced by a broadcast station. The sync amplitude of 40 IEEE units is often the reference against which the remainder of the luminance signal is compared. Circuits can be checked for sync clipping by observing the staircase pattern on an oscilloscope and checking whether the sync pulse amplitude remains 0.4 compared to the 100% white step which is a reference of 1.0. AGC circuits, which respond to sync pulse amplitude, can be checked by using COMP. VIDEO output and varying the level. The overall amplitude of the video can be varied, but the sync pulse amplitude is a constant percentage of the total video amplitude.

The precise timing of the sync pulses allows proper adjustment of servo circuits which control tape speed in VCRs, and switching circuits which should switch between video heads to allow a continuous transition from field to field.

SOUND

For VCRs and television receivers, sound may be added to the rf output. Note whether the sound signal is present in the video (usually diagonal lines through the pattern) with both a 1 kHz and 3 kHz tone applied. There should be no difference in the pattern with sound on or off. The sound signal also can be used for testing the sound circuits of VCRs and TV sets.

STUDIO APPLICATIONS

The precision and full featured capability of the Model 1260 NTSC Generator makes it well suited for professional applications such as television studios, cable television equipment rooms, and television transmission equipment rooms. A TCXO provides the high degree of accuracy and stability required for studio applications. Some of the 1260's features required in studio applications include "Gen Lock", black burst, and RGB signal generation, in addition to the signals already described in this section.

CCTV APPLICATIONS

Closed circuit television systems do not usually include a built-in NTSC color reference signal. The NTSC Generator can be used to supply such a reference. All equipment in the system can then be adjusted to the same reference while connected into or removed from the system.

Virtually all equipment used in CCTV systems is designed around certain standard signal conditions at the input and output terminals. This allows equipment to be compatible, without modification, when interconnected as a system. Among the standard signal conditions are positive polarity video signal (negative sync pulses), 1-volt peak-to-peak signal amplitude, 75-ohm impedance, and unbalanced line (one side grounded). The NTSC Generator has these characteristics, which simplifies set-up for testing, troubleshooting, and adjustment.

CATV APPLICATIONS

Cable television systems also use the standard signal conditions specified in the "CCTV Applications" paragraph at input and output terminals. The channel 3 or 4 rf output of the unit can be used throughout a CATV network to test, adjust, or troubleshoot amplifiers, cables, and any other equipment. The bandwidth of cable equalizers is easy to check with the gated multiburst pattern.

MATV APPLICATIONS

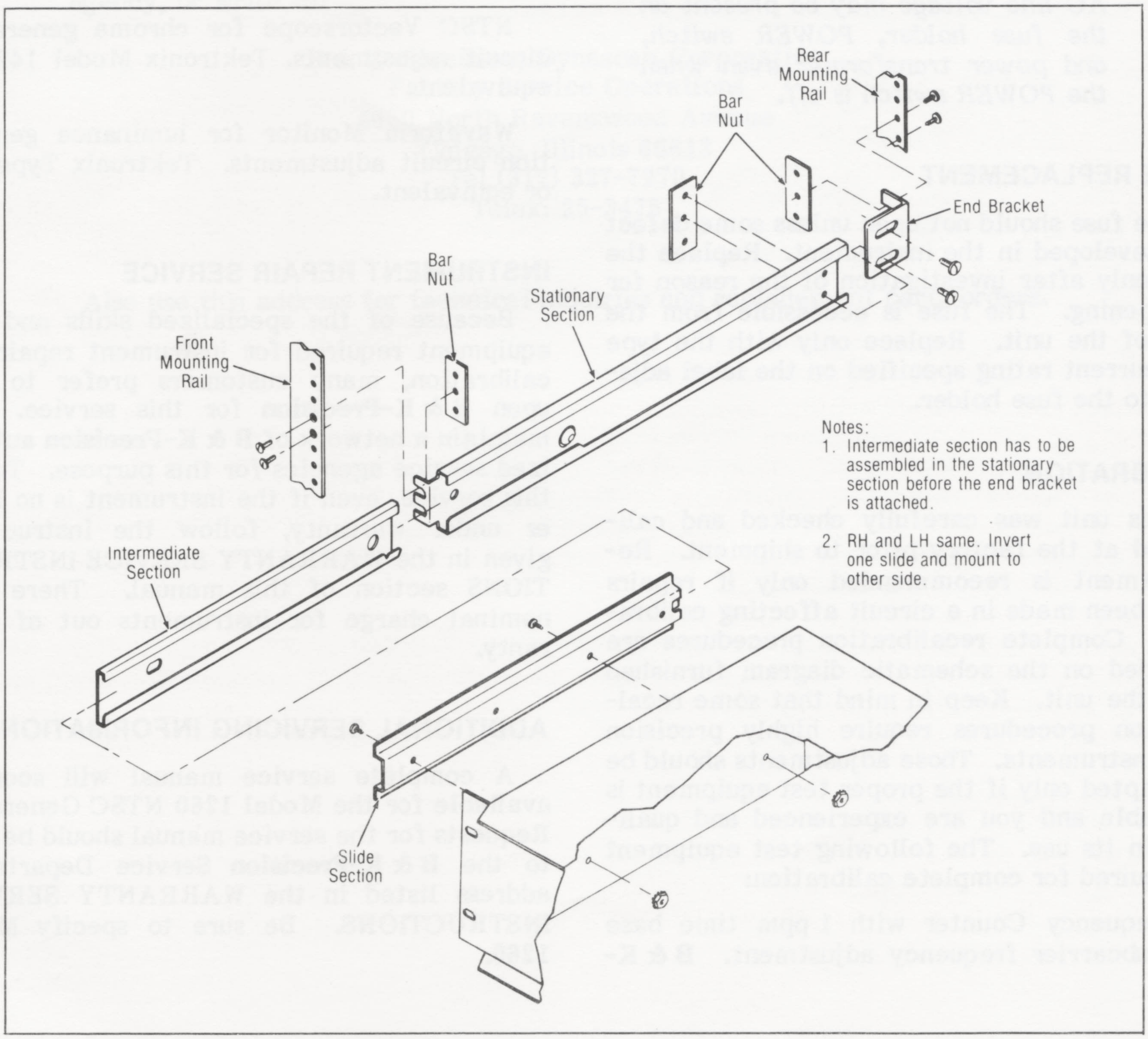
Master antenna systems for hotels, motels, apartment buildings, etc. can be checked by applying the channel 3 or 4 rf output of the NTSC Generator at the input of the network (or a branch of the network) and examining the pattern obtained on channel 3 or 4 directly from the screen of each TV set. To isolate problems in the distribution network from problems in an individual TV set, apply the channel 3 or 4 rf output of the instrument directly to the antenna terminals of the TV set. A proper display on the screen indicates a problem in the distribution network.

RACK MOUNT SLIDE KIT

The optional accessory Model RM-20 Rack Mount Slide Kit permits the Model 1260 NTSC Generator to slide in and out of a rack mount installation for easy access to rear panel jacks and for servicing. All mounting hardware and installation instructions are included.

The top cover must be removed from the NTSC Generator to attach the SLIDE SECTIONS to the chassis. A lip retains the top cover at the front edge of the instrument, and a latching screw on the rear panel (near HIGH LEVEL-LOW LEVEL switch) retains the rear edge. First remove the latching screw and lift the rear edge, then lift the top cover from the unit.

The two circuit boards along the left side of the instrument must be temporarily removed to attach the left SLIDE SECTION. Be sure to remove all connectors and mounting screws from the boards, and the knob and nut from the MULTIBURST VAR control, then carefully lift out the boards.



Notes:
1. Intermediate section has to be assembled in the stationary section before the end bracket is attached.
2. RH and LH same. Invert one slide and mount to other side.

SERVICING

WARNING

1. *The following instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.*
2. *A shock hazard is present when the top cover is removed if the power cord is plugged into an ac outlet. AC line voltage may be present on the fuse holder, POWER switch, and power transformer even when the POWER switch is off.*

FUSE REPLACEMENT

The fuse should not open unless some defect has developed in the instrument. Replace the fuse only after investigation of the reason for its opening. The fuse is accessible from the rear of the unit. Replace only with the type and current rating specified on the label adjacent to the fuse holder.

CALIBRATION

This unit was carefully checked and calibrated at the factory prior to shipment. Readjustment is recommended only if repairs have been made in a circuit affecting calibration. Complete recalibration procedures are included on the schematic diagram furnished with the unit. Keep in mind that some recalibration procedures require highly precision test instruments. Those adjustments should be attempted only if the proper test equipment is available and you are experienced and qualified in its use. The following test equipment is required for complete calibration:

Frequency Counter with 1 ppm time base for subcarrier frequency adjustment. **B & K-Precision** Model 1851 or equivalent. A frequency counter is also needed for sync and multiburst frequency adjustments; the Model 1851 is more than adequate for these adjustments.

100 MHz Oscilloscope for rf and sideband adjustments. **B & K-Precision** Model 1590A or equivalent. An oscilloscope is also needed for sound circuit adjustments and other adjustments of peak-to-peak voltage values. The Model 1590A far exceeds the test equipment requirements for these adjustments.

NTSC Vectorscope for chroma generation circuit adjustments. Tektronix Model 1420 or equivalent.

Waveform Monitor for luminance generation circuit adjustments. Tektronix Type 528 or equivalent.

INSTRUMENT REPAIR SERVICE

Because of the specialized skills and test equipment required for instrument repair and calibration, many customers prefer to rely upon **B & K-Precision** for this service. We maintain a network of **B & K-Precision** authorized service agencies for this purpose. To use this service, even if the instrument is no longer under warranty, follow the instructions given in the WARRANTY SERVICE INSTRUCTIONS section of this manual. There is a nominal charge for instruments out of warranty.

ADDITIONAL SERVICING INFORMATION

A complete service manual will soon be available for the Model 1260 NTSC Generator. Requests for the service manual should be sent to the **B & K-Precision** Service Department address listed in the WARRANTY SERVICE INSTRUCTIONS. Be sure to specify Model 1260.

WARRANTY SERVICE INSTRUCTIONS
(For U.S.A. and its Overseas Territories)

1. Refer to the MAINTENANCE section of your **B & K-Precision** instruction manual for adjustments that may be applicable.
2. If the above-mentioned does not correct the problem you are experiencing with your unit, pack it securely (preferably in the original carton or double-packed). Enclose a letter describing the problem and include your name and address. Deliver to, or ship PREPAID (UPS preferred in U.S.A.) to the nearest **B & K-Precision** authorized service agency (see list enclosed with unit).

If your list of authorized **B & K-Precision** service agencies has been misplaced, contact your distributor for the name of your nearest service agency, or write to:

B & K-Precision, Dynascan Corporation
Factory Service Operations
4050 North Ravenswood Avenue
Chicago, Illinois 60613
Tel (312) 327-7270
Telex: 25-3475

Also use this address for technical inquiries and replacement parts orders.

LIMITED ONE-YEAR WARRANTY

DYNASCAN CORPORATION warrants to the original purchaser that its **B & K-Precision** product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

DYNASCAN will, without charge, repair or replace, at its option, defective product or component parts upon delivery to an authorized **B & K-Precision** service contractor or the factory service department, accompanied by proof of the purchase date in the form of a sales receipt.

To obtain warranty coverage in the U.S.A., this product must be registered by completing and mailing the enclosed warranty registration card to DYNASCAN, **B & K-Precision**, 6460 West Cortland Street, Chicago, Illinois 60635 within fifteen (15) days from the date of purchase.

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. It is void if the serial number is altered, defaced or removed.

DYNASCAN shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have other rights which vary from state to state.

For your convenience we suggest you contact your **B & K-Precision** distributor, who may be authorized to make repairs or can refer you to the nearest service contractor. If warranty service cannot be obtained locally, please send the unit to **B & K-Precision** Service Department, 4050 North Ravenswood Avenue, Chicago, Illinois 60613, properly packaged to avoid damage in shipment.

B & K-Precision Test Instruments warrants products sold only in the U.S.A. and its overseas territories. In other countries, each distributor warrants the **B & K-Precision** products which it sells.

(continued from inside front cover)

8. In addition to the hot chassis shock hazard mentioned in item 7, severe damage to test instruments or the equipment being tested is probable from connecting a cable between the NTSC Generator and any "hot chassis" equipment unless an isolation transformer is used. The antenna terminals of a hot chassis set should already be isolated from the chassis, unless defective, and the isolation transformer may not be required. For connection to any other point, an isolation transformer is needed.

9. Capacitive coupled inputs and outputs of the Model 1260 NTSC Generator are rated at ±25 volts (dc + ac peak) maximum; this includes the RF OUT, VIDEO OUT, AUDIO OUT, and AUDIO IN jack. All other input and output jacks are direct coupled and are rated at ±5 volts (dc + ac peak) maximum. Make test connections at circuit points which do not exceed this value. If in doubt, first make voltage measurement with voltmeter or oscilloscope. Connection to higher voltage may damage the equipment.

10. When testing any ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as the on-off switch, fuses, power transformer, etc. any time the equipment is connected to an ac outlet, even if the equipment is turned off.

11. Servicing of this unit should be performed only by qualified electronics technicians who are trained to work safely in the presence of high voltage.

12. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.

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480-417-9-001

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